NOISE ASSESSMENT

TECHNICAL PAPER 3

Report No 05231-GT
Version A

MUNMORAH GAS TURBINE FACILITY

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September 2005

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1 INTRODUCTION

A proposed gas turbine facility is to be located to the northeast of the existing turbine hall at Munmorah Power Station. The turbines would be supplied with gas via a new pipeline to be constructed between the power station and generally following an existing transmission line easement to the Sydney Newcastle main gas line. The site and pipeline are shown in Figure 1-1.

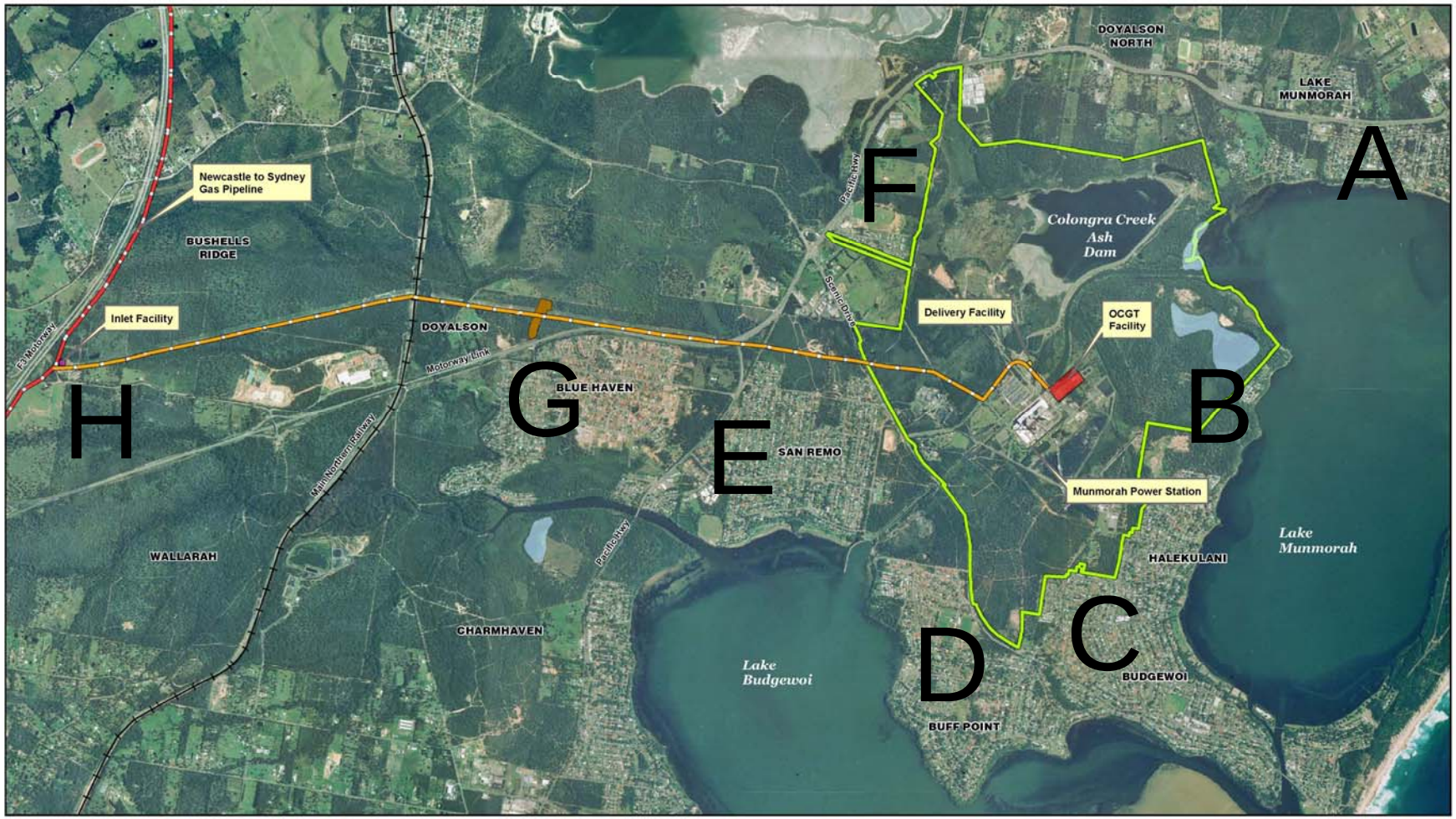
The facility comprises of four gas turbines and is proposed as "peaking plant" which means they only operate during periods of high demand, most likely to be during the daytime in summer but also possibly during the night time in winter.

This report assesses the potential noise impacts associated with the operation of the proposed turbines and also the compressor stations at the Gas Inlet Facility at the junction of the Sydney Newcastle main gas line stations along the proposed gas line. The report considers the construction noise impacts associated with the new facility and underground pipeline.

The assessment has been conducted in accordance with the requirements of the NSW *Industrial Noise Policy (INP)* and considered both intrusiveness and amenity. This is necessary since it is proposed that the gas turbines are located on a lot that may be operated independently from the existing facility in the future. For this reason, the noise criteria have needed to address the existing noise levels from the current operations on the site as an existing industrial noise source.

In addition, construction noise has been addressed in accordance with the requirements of Chapter 174 of the *Environmental Noise Control Manual (ENCM).*

Figure 1-1 Location Map showing Site, Pipeline and Noise Catchment Areas



2 SITE DESCRIPTION & PROPOSED OPERATION

The existing Delta Electricity site comprises the main power station and associated coal handling facilities. The proposed gas turbine facility would comprise four gas turbines located on a lot to the northeast of the existing turbine hall as shown in Figure 2-1. The turbines would be supplied by gas from a new underground pipeline which would connect to the Sydney Newcastle main gas pipeline adjacent to the F3 freeway.

The four turbines are proposed to operate as "peaking plant" and would therefore only operate for a limited number of hours per year. This is most likely during hot summer days but could also occur during the night time in winter.

The three main noise sources associated with each of the four gas turbines are from the air intake, the noise radiated from turbine/generator enclosure and the exhaust stack.

Adjacent to the Sydney Newcastle main gas line an inlet facility will be provided which comprises a compressor used to charge the pipeline following use of the gas turbines. It is likely that it could operate up to 24 hours at a time. This is located approximately 100m from the nearest residence.

The surrounding residential receivers have been split into a number of catchment and sub-catchment areas as follows. These residential receivers also include holiday villages and caravan parks.

- Noise Catchment A - Lake Munmorah. Residential area to the northeast with residences located along Kamilaroo Avenue overlooking the lake and also at the Lakeside Leisure Village. Approximately 2.25km.
- Noise Catchment B. Residential area to the east with residences along Macleay Avenue and including the Sunnylake Caravan Park. Approximately 910m.
- Noise Catchment C. The residential area to the southeast and south of Halekulani and Budgewoi, in particular, residences located along Woolana Avenue, Kalele Avenue and Ulana Avenue. Approximately 1.2km.
- Noise Catchment D. The residential area to the southwest in Buff Point with the nearest residences located in Barega Close. Some of these residences would be shielded by the existing power station buildings. Approximately 1.65km.
- Noise Catchment E. The residential area to the west in San Remo with the closest residences along Barker Avenue. Approximately 1.45km.
- Noise Catchment F. The residential area to the northwest in Colongra with residences located along Wentworth Avenue, Denman Street and Barton Road. Approximately 1.65km.

The site is generally flat at an RL of between 5 and 10m. Generally, the surrounding residences are at a similar RL, although those slightly further away can be elevated up to 10–20m above site level but many would be shielded by adjoining residences.

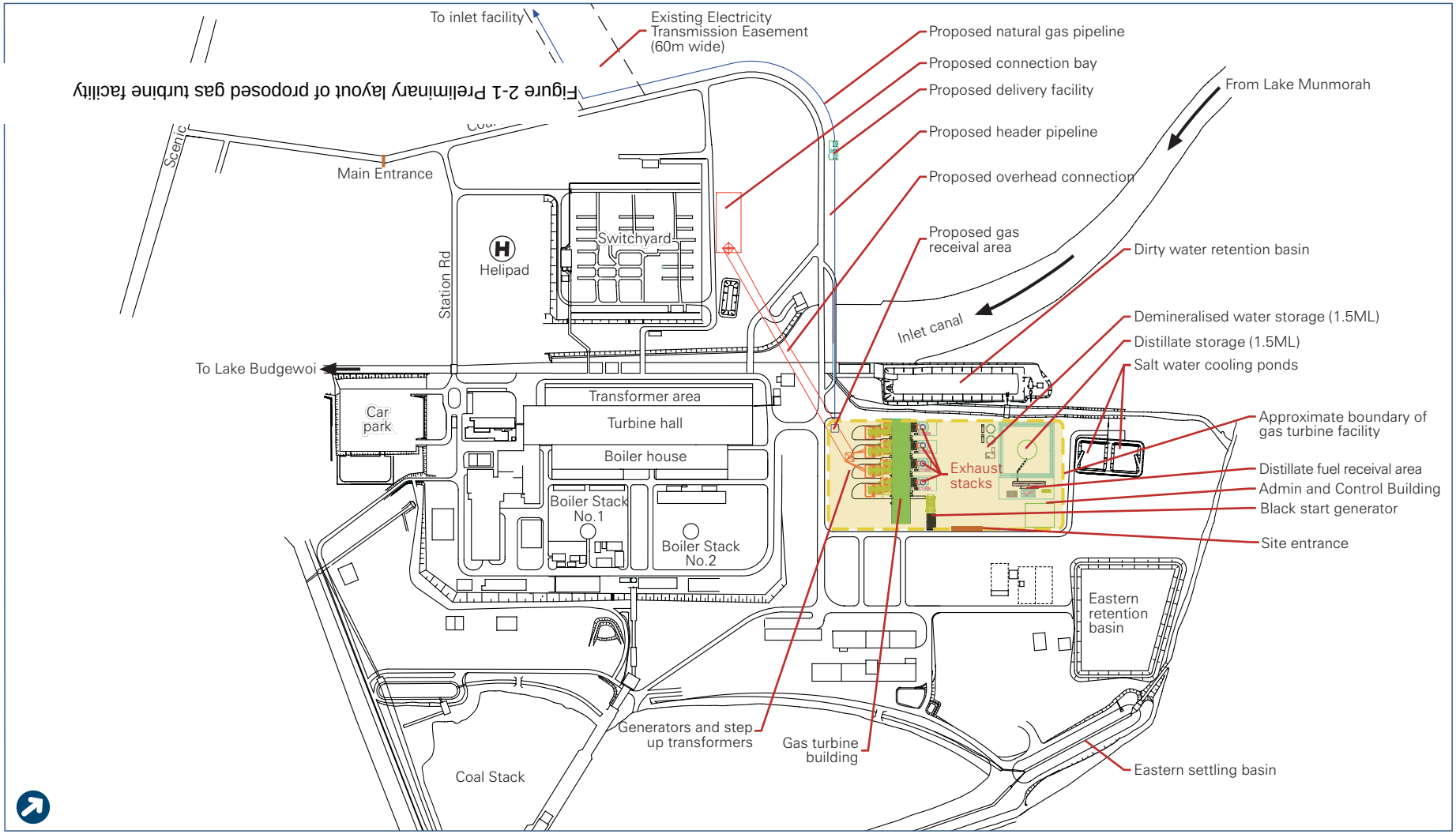


Figure 2-1 Preliminary layout of proposed gas turbine facility

3 EXISTING NOISE ENVIRONMENT

Ambient and background noise levels were measured at four residential receivers representative of the various noise catchment areas from 19 to 29 August 2005. In addition, attended noise measurements during both the daytime and night time were conducted.

Given that there is some noise associated with the existing industrial operations, it was decided to generally locate the noise loggers at residential receivers which were not directly exposed to the existing site in order to obtain the background noise level typical of the residential area rather than including any existing industrial noise.

The attended measurements supplemented this information by confirming whether existing site noise was audible at the unattended logger locations.

3.1 Unattended Noise Measurements

The unattended noise monitoring locations are summarised as follows:

- Location 1 – 14 Kamilaroo Avenue, Lake Munmorah (Noise Catchment A). The logger was placed in the front yard of the dwelling facing the street.
- Location 2 – 127 Woolana Road, Budgewoi (Noise Catchment C). The logger was placed in the front yard of the residence on the eastern side of Woolana Road.
- Location 3 – 32 Barega Close, Buff Point (Noise Catchment D). The logger was located in the front yard of the residence.
- Location 4 – 83 Perouse Avenue, San Remo (Noise Catchment E). This residence is on the western side of Perouse Avenue and the logger was placed in the front yard.

3.1.1 Measurement Procedure

The noise monitoring equipment used for these measurements consisted of environmental noise loggers set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Appendix A for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. This is used for the assessment of sleep disturbance. The L_{A90} level is normally taken as the background noise level during the relevant period.

3.1.2 Measurement Results

The results are shown graphically in Appendix B and summarised in the Tables below.

Meteorological data during the survey period was collected and indicated there were only a few 15-minute periods, potentially affected by high wind and there was no rain during this period. This data has been excluded in accordance with the procedures of the *INP*.

In addition to showing the measured RBL over the survey period, the lowest ABL is also presented.

3.2 Attended Noise Measurements

3.2.1 Measurement Procedure

Daytime noise measurements were carried out using a Rion NA27 precision sound level meter and for the night time measurements a Bruel & Kjaer Type 2250 sound level meter was used. Both units were calibrated before and after the survey and no significant drift occurred.

3.2.2 Attended Measurement Results

Table 3-1 summarises the results of the daytime measurements and Table 3-2 summarises the results of the night time measurements.

Table 3-1 Unattended Noise Monitoring Results

Noise Catchment Area	Receiver	RBL (dBA)			Lowest ABL at Night (dBA)
		Day	Evening	Night	
A	Kamilaroo Ave	38	38	37	35
C	Woolana Ave	36	33	34	32
D	Barega Cl	37	40	36	33
E	Perouse Ave	39	38	34	33

Table 3-2 Attended Noise Monitoring Results

Noise Catchment Area	Address	Time	Measured Noise Level (dBA)		Comment
			L_{Aeq}	L_{A90}	
A	14 Kamilaroo Ave	14.30-14.45	52	41	No constant industry audible; Distant traffic along Pacific Highway audible at 42-43dBA; Local fauna (birds) ≈ 40-45dBA up to 49dBA; Local road traffic noise observed at 50-58dBA during passby, 59-62dBA (passby of two cars), 55-65dBA passby at 'speed'; Short-term leave rustling audible at 44-45dBA; Ambient level ≈ 38-39dBA (minimum traffic).
		21.30-22.00	37	34	Distant traffic 35-38dBA; Natural environment 34-35dBA; No industrial noise.
C	127 Woolana Rd	12.45-13.00	46	36.5	No constant industry audible during monitoring interval; Local fauna ≈ 38-43dBA; Single excavator opening (grubbing works) in colliery observed at 37-39dBA with short-term impacts of 42-45dBA and reversing alarm ≈ 42-43dBA; Local fauna (birds) 49-57dBA; No road traffic noise influence; Ambient level 38-39dBA.
		23.30-24.00	30	29	Natural environment 33-36dBA; Low hum from Delta site 29-31dBA.
D	32 Barega Cl	13.25-13.40	47	42	No constant industry audible during monitoring interval Road traffic noise predominate (Scenic Road); Local fauna audible throughout; Ambient Level. ≈ 42-44dBA at 'heavy' traffic flows / road transport truck passage. Short-term peaks of 46-47dBA; Ambient level ≈ 39-40dBA at 'standard' traffic flows.
		22.55-23.20	46	44	Distant traffic up to 44-46dBA; Natural environment 40-43dBA; No industrial noise; Dog barking up to 64dBA.
E	83 Perouse Ave	14.05-12.20	47.5	40	No constant industry audible; Local fauna ≈ 40-49dBA; Local road traffic noise observed 42-43dBA up to 45-51 dBA with peaks of 54-57dBA; Local fauna audible throughout; Intermittent leave rustling audible at 40-41dBA; Ambient level ≈ 38-39dBA.
		22.20-22.40	38	36	Distant traffic 35-37dBA; Natural environment 38-40dBA; No industrial noise.

4 OPERATIONAL NOISE LEVEL CRITERIA

Noise level criteria have been established in general accordance with the requirements of the NSW *Industrial Noise Policy (INP)* and have considered both intrusiveness and amenity. Given that the existing power station and associated operations do generate some noise in the surrounding residential areas, the criteria have been established, both considering this existing contribution and also allowing for future changes.

4.1 Industrial Noise Policy

The *INP* recommends two criteria, "Intrusiveness" and "Amenity", both of which are relevant for the assessment of noise. In most situations, one of these is more stringent that the other and dominates the noise assessment. The criteria are based on the L_{Aeq} descriptor, which is explained in Appendix A.

4.1.1 Intrusiveness Criterion

An intrusiveness criterion applies for residential receivers only.

The intrusiveness criterion requires that the L_{Aeq} noise level from the source being assessed, when measured over 15 minutes, should not to exceed the Rating Background Noise Level (RBL) by more than 5dBA. The RBL represents the "background" noise in the area, and is determined from measurement of L_{A90} noise levels, in the absence of noise from the source. The definition of L_{A90} and the procedure for calculating RBL is given in Appendix A.

Where the noise level from the source varies over time, due to changes in operating conditions, meteorological conditions or other factors, the upper 10^{th} percentile of 15-minute L_{Aeq} noise levels can be used for comparison with the criterion.

4.1.2 Amenity Criterion

The amenity criterion sets a limit on the total noise level from *all industrial noise sources* affecting a receiver. Different criteria apply for different types of receiver (e.g. residence, school classroom); different areas (e.g. rural, suburban); and different time periods, namely daytime (7.00am–6.00pm), evening (6.00pm–10.00pm) and night time (10.00pm–7.00am).

The noise level to be compared with this criterion is the L_{Aeq} noise level, measured over the time period in question, due to all industrial noise sources, but excluding non-industrial sources such as transportation.

Where a new noise source is proposed in an area with negligible existing industrial noise, the amenity criterion for that source may be taken as being equal to the overall amenity criterion. However, if there is significant existing industrial noise, the criterion for any new source must be set at a lower value. If existing industrial noise already exceeds the relevant amenity criterion, noise from any new source must be set well below the overall criterion to ensure that any increase in noise levels is negligible. Methods for determining a source-specific amenity criterion where there is existing industrial noise are set out in the *INP*.

4.2 Project Specific Criteria

Given the unattended noise monitoring results and the attended noise monitoring results indicated at the measurement locations, existing industrial noise was either inaudible or only barely audible at night time. The approach to establishing noise level criteria is discussed below.

Although the gas turbine facility is unlikely to operate at night time on a regular basis, it is possible that it could operate at night time and therefore this period has been assessed as the most stringent. In addition, it is possible at some residential locations the RBL may be partially affected by existing industrial noise. However, it is considered the lowest ABL measured at night time is likely to be representative of the true background noise level at the residential receivers in the absence of any industrial noise.

Since the plant would not operate continuously, it is also considered that intrusiveness rather than amenity is the most relevant criterion.

On this basis, the project criteria have been set at 5dBA above the lowest ABL measured at each site. For those noise catchment areas where measurements were not undertaken, the ABL at the nearest catchment area was adopted. Table 4-1 summarises the proposed criteria.

Table 4-1 Operational Noise Level Criteria

Noise Catchment Area	Residential Areas	Noise Level Criterion (dBA)
A	Lakeside Village	40
	Kamillaroo Drive	40
B	Sunnylake Caravan Park	37
	Macleay Street	37
C	Woolana Road	37
	Ulana Road	37
D	Barega Close	38
E	Baker Street (south)	38
	Baker Street (north)	38
F	Denman Street	38

As discussed above, the night time amenity criterion $L_{Aeq,9hr}$ for a suburban / rural area is an “acceptable” level of 40dBA and a “recommended maximum” level of 45dBA. Adopting criteria of 37dBA and 38dBA for the contribution of noise from the proposed gas turbine facility alone (remembering it would not operate all the time) is considered sufficiently below the amenity criterion that negligible impacts would occur.

At the furthest receivers in Noise Catchment Area A, although a criterion of 40dBA has been adopted, it is likely that any noise control to meet criteria of 37-38dBA at the closer residences would result in noise levels much lower than this criteria at these residences. At this location, noise from existing industry was inaudible both at daytime and night and was dominated by traffic noise along the Pacific Highway and the natural environment. For this reason, allowing a noise contribution of 40dBA from the proposed gas turbine facility is considered appropriate. Even allowing for other industrial noise, this criterion would also only result in total industrial noise falling between the “acceptable” amenity level and the “recommended maximum” level.

Background noise levels have not been measured at the nearest residence to the inlet facility, however it is likely to be affected by noise from the F3 Freeway. It is considered the amenity criterion of 40dBA should apply for this residence.

5 PREDICTED OPERATIONAL NOISE LEVELS

As discussed in Section 2, the gas turbines comprise three main noise sources:

- air intake
- turbine / generator noise radiated from the enclosure
- exhaust duct noise from the stack

Noise level data from a generic turbine of the proposed size has been provided as follows:

- air intake sound power level 103dBA; assumed source height 15m
- turbine / enclosure 85dBA at 1m; assumed source height 4m
- exhaust stack sound power level 98dBA; assumed source height 30m

Noise from the air intake is likely to be reasonably directional and the turbines have been oriented such that the air intake faces the existing power station where the building may provide some shielding to any residences beyond. This shielding has been included in the noise predictions.

In addition, the noise emanating from the discharge stack would also be directional in relation to surrounding residences typically at 90º to the discharge direction. For this reason, a correction was subtracted from the sound power level provided above in order to model noise from a source at this height propagating to the residences.

Since the four turbines are located adjacent to each other, it has been estimated based on the surface area of the enclosure that the 85dBA at 1m specification is equivalent to a sound power level of 111dBA for the two outer turbines and a reduced sound power level of 101dBA for the two inner turbines. These sound power levels have been included within the ENM noise model.

5.1 Prediction Procedure

Noise levels were predicted using the software Environmental Noise Model (ENM). This model takes into account geometric spreading, ground effects and shielding provided by topography. It is also capable of predicting noise under differing meteorological conditions.

Table 5-1 summarises the predicted noise levels under neutral and typical adverse (temperature inversion of 3º per 100m) meteorological conditions. Noise level contours showing the $L_{Aeq,15min}$ level are shown in Figures 5-1 (Neutral) and Figure 5-2 (Adverse).

Table 5-1 Predicted Noise Levels

Noise Catchment Area	Residential Areas	Noise Level Criterion	Predicted $L_{Aeq,15min}$ Noise Level (dBA)

		(dBA)	Neutral	Typical Adverse
A	Lakeside Village	40	21	23
A	Kamillaroo Drive	40	19	22
B	Sunnylake Caravan Park	37	27	29
	Macleay Street	37	35	38
C	Woolana Road	37	34	37
	Ulana Road	37	32	35
D	Barega Close	38	28	31
E	Baker Street (south)	38	18	21
	Baker Street (north)	38	30	32
F	Denman Street	38	24	29

It can be seen from Table 5-1 that under neutral conditions noise levels are generally well below the criterion although at the closest residences to the east and southeast in Noise Catchment Areas B and C the criteria are only just met.

Under typical adverse meteorological conditions, noise levels typically increase by 2-3dBA, however still achieve the criteria at all noise catchment areas with the exception of the closest residences in Noise Catchment Area B located on Macleay Street. Given that the exceedance is only marginal (1dBA) and the plant would rarely operate in the middle of the night it is considered that noise levels would exceed the criterion less than 10% of the time in any one season and overall impacts would be considered negligible. In addition, even under these adverse noise conditions, the predicted noise level would still comply with the amenity criterion of 40dBA.

On this basis, no further mitigation is warranted however, it is essential that compliance testing is conducted to ensure the gas turbines installed meet the noise levels provided in the specification.

Figure 5-1 Neutral Meteorological Conditions

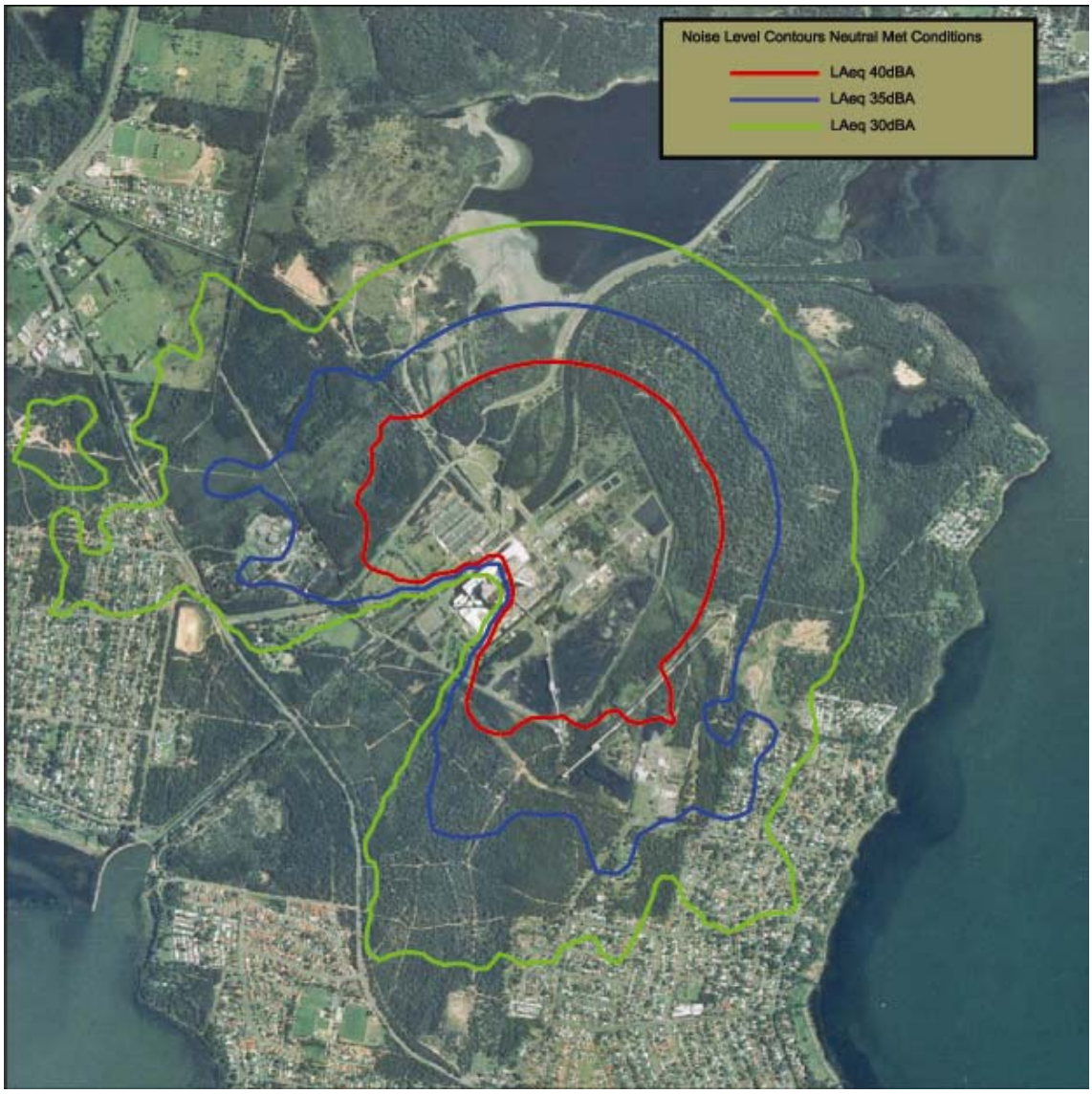
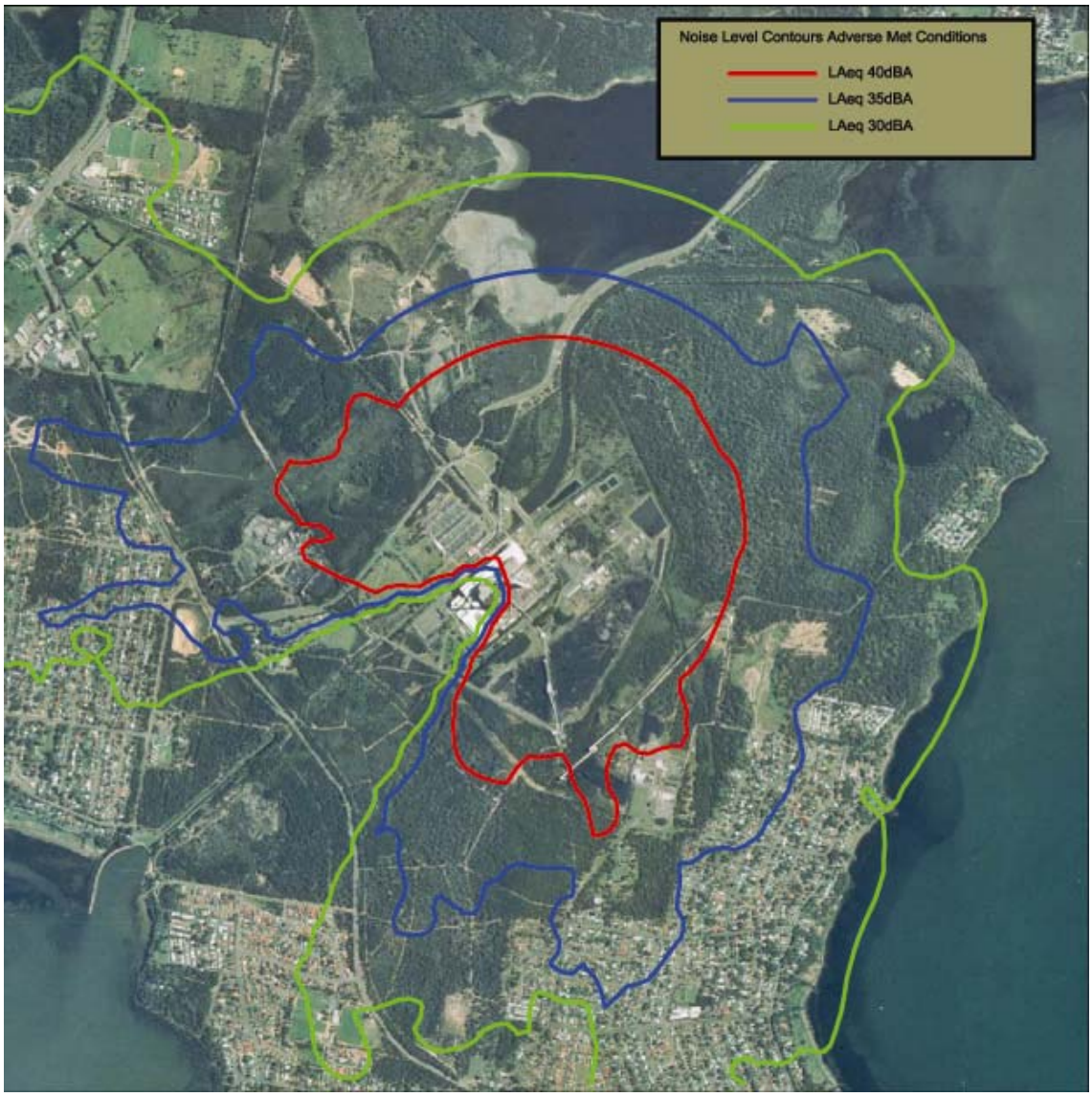


Figure 5-2 Adverse Meteorological Conditions



5.1.1 Statistical Analysis of Potential Noise Impacts Due to Meteorological Effects

More detailed analysis of the worst case adverse meteorological conditions indicate with temperature inversions of 5º per 100m and a wind speed from source to receiver of 3m/s noise levels 2-3dBA higher than shown in Table 5-1 are possible although infrequent. Since noise levels under worst case adverse meteorological conditions are predicted to exceed the night time intrusiveness criteria at three of the residences to the east and southeast in Noise Catchment Areas B&C, it is important to quantify the proportion of time that this may occur to better understand the potential noise impacts. Generally, the likelihood of concurrent wind speed and wind direction leading to noise levels significantly above the criteria is low. However, this higher degree of affectation can result if prevalent wind conditions dominate in certain directions.

Records of wind speed and direction were obtained for the meteorological station at the site for three years. This data has been processed to determine the likelihood of either wind or temperature inversions affecting the propagation of noise. Taking into account prevalent wind conditions or temperature inversions, statistical modelling was undertaken to determine the proportion of time that exceedances of the relevant criteria could occur in any one season.

A total of 110 separate meteorological condition combinations were considered – wind speeds of 1-3m/s in each of eight directions, and zero wind speed (representing both zero wind and wind speeds above 3m/s) with associated temperature inversions. Noise levels were calculated under each of these conditions, and the probability of occurrence of each wind condition was taken into account to determine the percent of time that noise levels could exceed the relevant criterion.

The results are separated into seasons and tabulated below in Table 5-2. Results are provided in percentile bands. Table 5-2 shows the proportions of time that meteorological conditions are predicted to give rise to noise levels in excess of the daytime criteria for Scenario 1.

Table 5-2 Proportion of Operating Hours Resulting in Noise Level Exceedance

Receiver	Night $L_{Aeq,15min}$ Criterion (dBA)	Proportion of Time if Continuous (%)			
		Summer	Autumn	Winter	Spring
B - Macleay	37	6	11	23	15
C - Woolana	37	5	8	15	10
C - Ulana	37	3	6	5	4

These proportions assume the Gas Turbine Facility would be operating continuously. However the total time of operation in a year is estimated at 500 hours, with most of these during daytime hours. The proportion of time would reduce by a factor of approximately 10, when considering the likely use at night time during the winter season and much higher factors for the other months.

On this basis the percentage of time, exceedances may occur is generally less than 1% and at worst less than 2% in winter.

5.2 Inlet Facility

During the detailed design phase it will be necessary to confirm the background noise levels at night time and ensure the design of the building is sufficient to achieve this noise level. Given the distance to the residence is approximately 100m, conventional noise control measures and building construction would be sufficient.

6 CONSTRUCTION NOISE IMPACTS

This section of the report assesses the potential impact of noise during the construction of the Gas Turbine Facility and new pipeline. The potential impacts from construction noise have been assessed in accordance with the requirements of Chapter 174 of the *Environmental Noise Control Manual (ENCM).* No activities would occur close enough to any residences for there to be any issues regarding vibration.

6.1 Construction Activities

6.1.1 On Site Activities

Site clearing, earthworks and construction of the foundations is expected to take approximately 8-9 months with the installation and commissioning of equipment to follow over 2-3 months. Operations would occur in the following three phases:

- Earthworks and drainage
- Foundation and paving works
- Superstructure erection

6.1.2 Pipeline Activities

The pipeline follows the existing transmission line alignment shown in Figure 1-1. This will require excavation of a trench, installation of the pipe sections, welding and then backfilling. The total duration is nine months, concurrent with the Gas Turbine Facility, however noise will only occur in the vicinity of each receiver for a few weeks. At the crossing of the Pacific Highway and railway directional drilling will be required, however this is expected to be quieter than the conventional methods.

6.1.3 Inlet Facility

The construction and installation process is similar to the on site activities, although on a much smaller scale and is expected to last 2-3 months.

6.2 Construction Noise Criteria

Guidelines for assessment of construction noise are specified in the Environmental Noise Control Manual, Chapter 171 (NSW Environment Protection Authority, 1994) and are as follows:

- For periods of four weeks or less, the L_{A10} level should not exceed the background (L_{A90}) level by more than 20dBA.
- For periods greater than 4 weeks and less than 26 weeks, the L_{A10} level should not exceed the background (L_{A90}) level by more than 10dBA.

Although not clearly stated by the Department of Environment and Conservation (DEC), it is considered that for construction periods longer than 26 weeks, the L_{A10} noise level should not exceed the L_{A90} level by more than 5dBA. It is accepted that for determining noise criteria, the L_{A90} background noise level should be quantified by the Rating Background Level value.

In addition, the DEC specifies the following time restrictions for construction activities where the noise is audible at residential premises:

- Monday to Friday 7.00am-6.00pm
- Saturday 8.00am-1.00pm
- No construction work is to take place on Sundays or Public Holidays

The DEC noise criteria are objectives to try and achieve. Where they can not be met DEC recommends that a "best practice" approach be used to ensure that all possible steps are taken to reduce noise levels of construction site equipment so as to minimise the impact of construction noise.

The duration of construction of the total Gas Turbine Facility and pipeline project would exceed 26 weeks, therefore the construction noise objective would be that the L_{A10} noise level should not exceed the RBL level by more than 5dBA. Table 6-1 summarises the relevant construction noise criteria for those residential receiver locations potentially affected by construction noise from the proposal based on the measured RBL's summarised in Section 3.

Table 6-1 Construction Noise Criteria

Noise Catchment	Receiver	Daytime RBL (dBA)	Criteria
A	Kamilaroo Ave	38	43
C	Woolana Ave	36	41
D	Barega Cl	37	42
E	Perouse Ave	39	44

Since pipeline activity is likely to occur for less than 4 weeks in close proximity to any receivers a criterion of RBL + 20dBA would be appropriate. Background noise levels have not been measured at these locations, however at daytime these receivers along the pipeline alignment would be affected by traffic noise from either the Pacific Highway or the F3 Freeway. Daytime background noise levels of 45-50dBA would be likely, therefore a criterion of 65-70dBA is probably appropriate.

6.3 Construction Noise Sources

The following construction plant items and associated maximum SWL are summarised as follows:

- Front-end Loader 110dBA

- Dozer 113dBA
- Excavator 107dBA
- Grader 107dBA
- Concrete/Tip Truck 109dBA
- Concrete Vibrator 103dBA
- Mobile Crane 110dBA
- Hand Tools (up to) 113dBA
- Air Compressor 100dBA

Based on a typical worst case operating scenario involving use of the dozer, excavator and truck, the combined SWL for the construction activities is calculated as:

- On site Earthworks and Foundations 115dBA
- On Site Installation 113dBA
- Pipeline 112dBA

6.4 Predicted Construction Noise Levels

Taking into account attenuation due to distance and intervening topography, the following range of L_{A10} noise levels are predicted at the nearest residences for the construction phase. These are shown in Table 6-2 for on site activities and 6-3 for the pipeline and inlet facility.

Table 6-2 Construction Noise Levels at Receivers from On Site Activities

Noise Catchment	Receiver	Predicted Construction Noise LA10, 15min Noise Level (dBA)		Criterion (7am-6pm
		Earthworks	Installation	
A	Kamilaroo	21	19	43
A	Lakeside	18	16	43
B	Sunnylake	27	25	41
B	Macleay	37	35	41
C	Woolana	34	32	41
C	Ulana	16	14	41
D	Barega	14	12	42
E	Barker (Sth	11	9	44
E	Barker (Nth)	28	26	44
F	Denman	23	21	44

Due to the distances to the receivers, the typical construction noise levels at all receivers are below the criterion.

Table 6-3 Construction Noise Levels at Receivers from Pipeline and Inlet Facility

Noise Catchment	Predicted Construction Noise $L_{A10, 15min}$ Noise Level (dBA)	
	Pipeline	Inlet Facility
E – San Remo	64	-
F - Colongro	41	-
G – Blue Haven	71	-
H – Adjacent F3	70	64

Due to the smaller distances to the closest receivers, the typical construction noise levels are likely to exceed criteria where construction activities occur within 100 - 150m of any residence. This is only likely to occur for a short period.

6.5 Mitigation of Construction Noise

It is quite common that construction noise exceeds the DEC-EPA criteria. Mitigation measures for these marginal exceedances required by the DEC-EPA would rely on the management of noise using a combination of the following:

- Construction Hours
- Review of proposed construction Methodologies to minimise noise and vibration
- Use of modern well maintained equipment with appropriate mufflers
- Noise and Vibration Monitoring
  - Plant Items on Site
  - At Sensitive Receiver
- Training and Awareness
- Complaint Handling

These can be reviewed in more detail in a Construction Noise Impact Statement when more details of construction methodology and plant numbers etc are known.

7 CONCLUSION

The potential operational and construction noise impacts due to the proposed Gas Turbine Facility and associated pipeline and inlet facility has been assessed in accordance with the NSW Department of Environment & Conservation *Industrial Noise Policy (INP)* and the *Environmental Noise Control Manual (ENCM)*.

It is assumed the gas turbines will be designed to meet the specified noise levels provided in Section 5. This includes the acoustic enclosures supplied with the equipment.

Although the plant only operates intermittently at periods of high demand (hot summer days) it is possible the plant would operate at night time most probably in winter. Under neutral weather conditions the predicted noise levels would meet the criteria at all residences. Noise contours are shown in Figure 5-1. Under typical adverse conditions a marginal exceedance of 1 dBA at one residential area to the east is predicted (shown in Figure 5-2.

Detailed assessment of more extreme adverse meteorological conditions indicates exceedances of up to 4dBA are possible at additional residential areas, generally to the east and south east although the concurrence of night time plant operation and adverse weather is likely to be rare.

Based on 3 years of historical meteorological data the proportion of time the criteria would be exceeded is summarised in Section 5.3 and when allowing for only occasional use of the plant the exceedance would be less than 2% of the time in the worst season. On this basis negligible impact would be expected.

The inlet facility building required to house the compressor used to charge the line will need to be designed to ensure criteria are met at the nearest residence.

Construction noise associated with the Gas Turbine Facility is predicted to meet the criteria at all residences. However during construction of the pipeline some exceedances are predicted when activities are within 100-150m from any residence. The duration of this noise is only expected to last a total of a few weeks as activities pass by.

Version	Status	Date	Prepared by	Checked by
A	Final	29 September 2005	Neil Gross	Tim Dean

APPENDIX A

NOISE DESCRIPTORS

NOISE DESCRIPTORS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

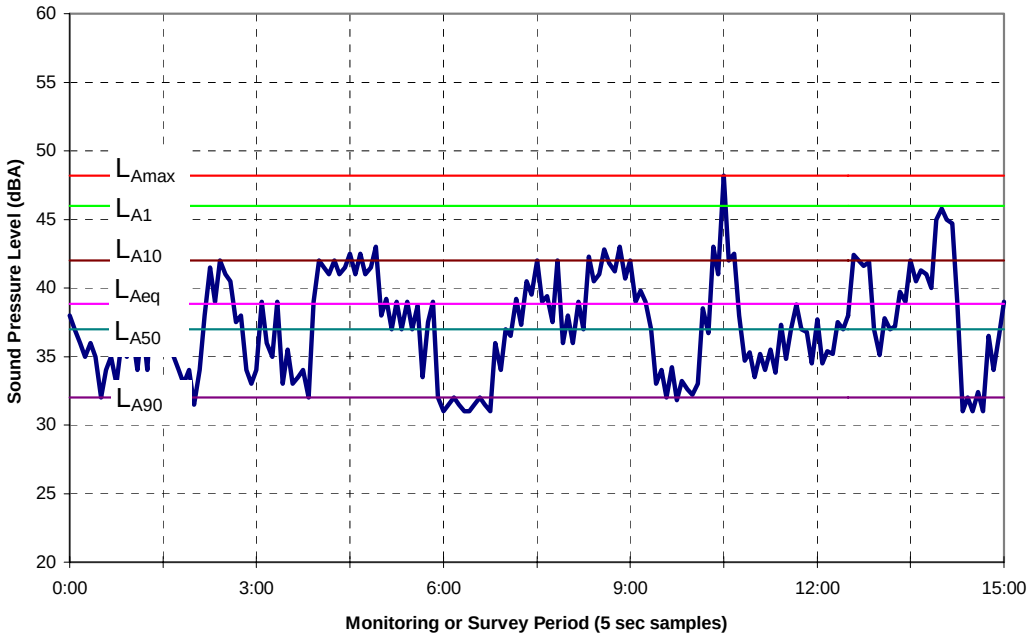
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (day, evening and night) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period, day, evening and night.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)

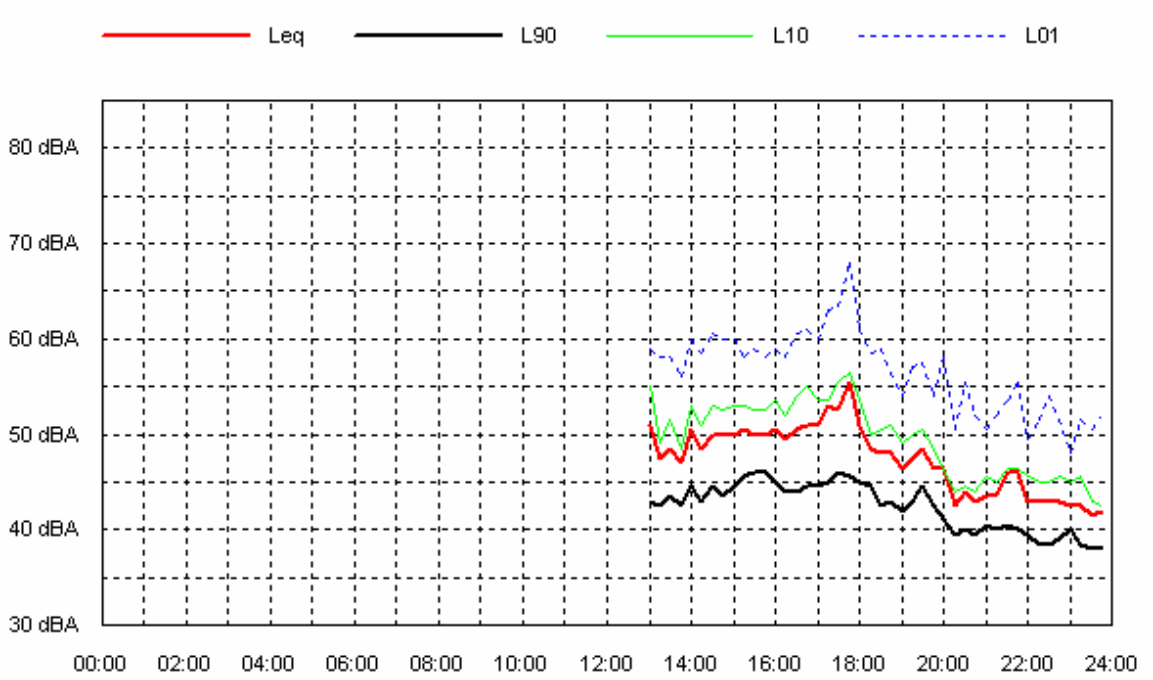
APPENDIX B

NOISE MEASUREMENT GRAPHS

Location: 14 Kamilaroo Avenue

Data shaded: Wind

Fri 19 Aug 05



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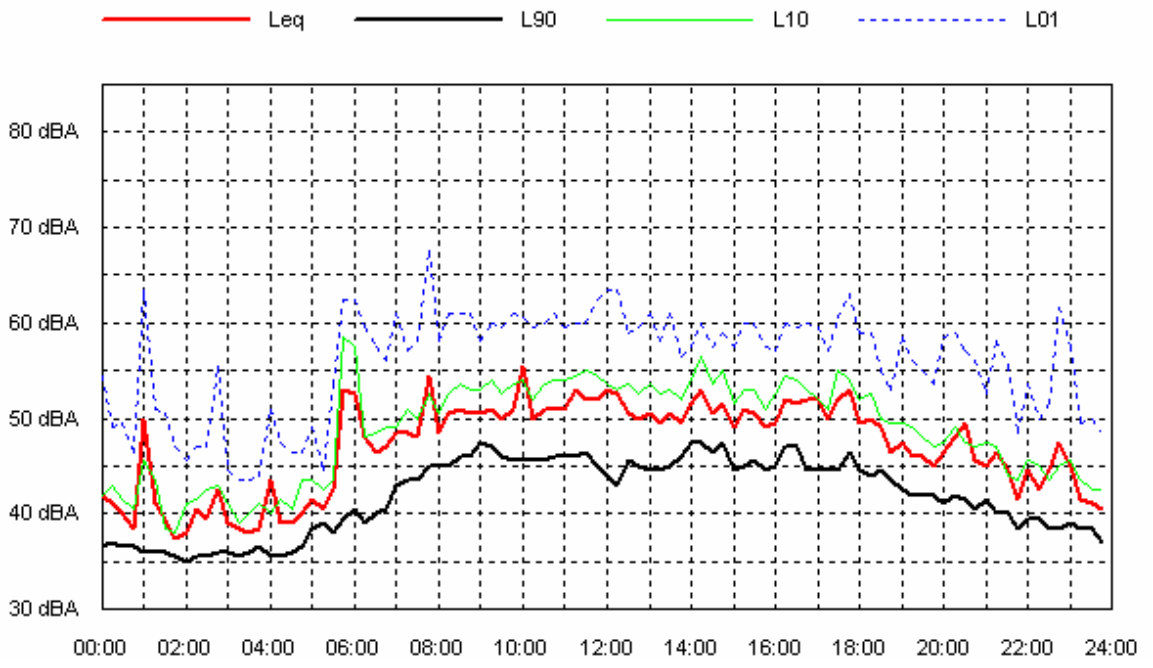
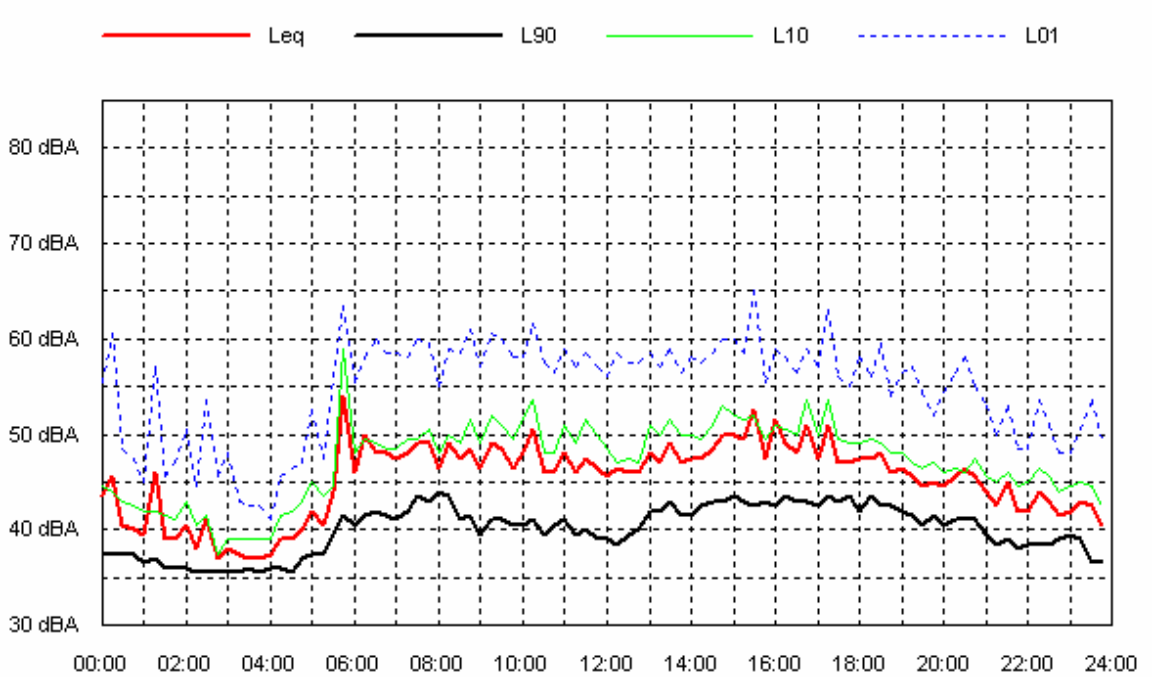


Location: 14 Kamilaroo Avenue

Data shaded: Wind

Sun 21 Aug 05



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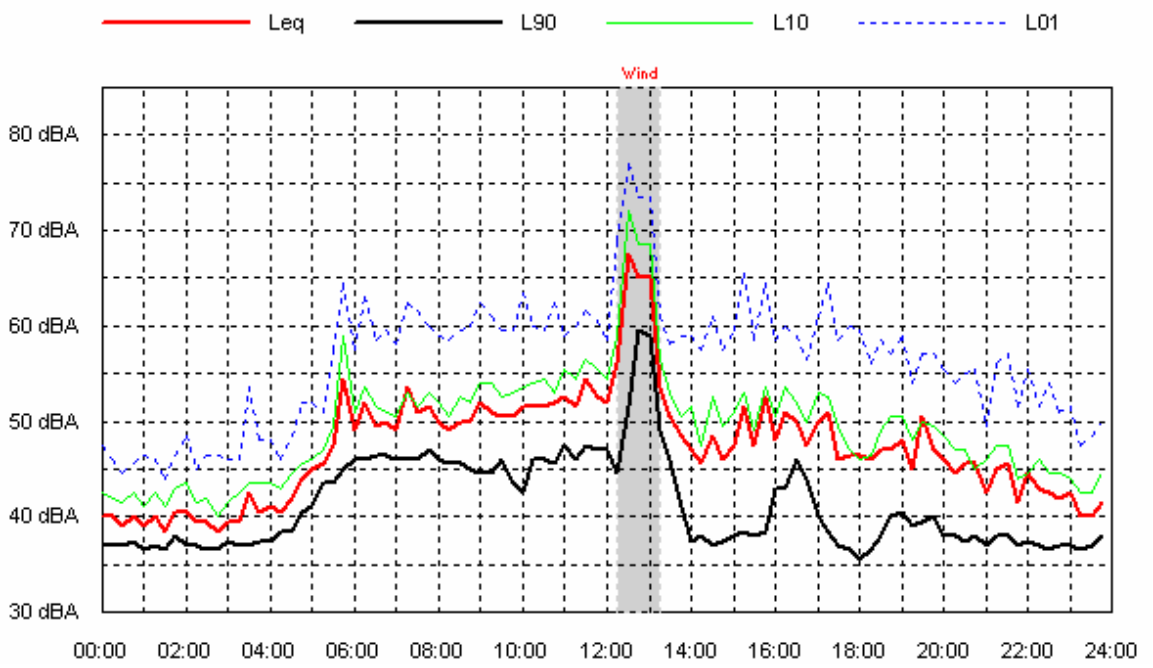
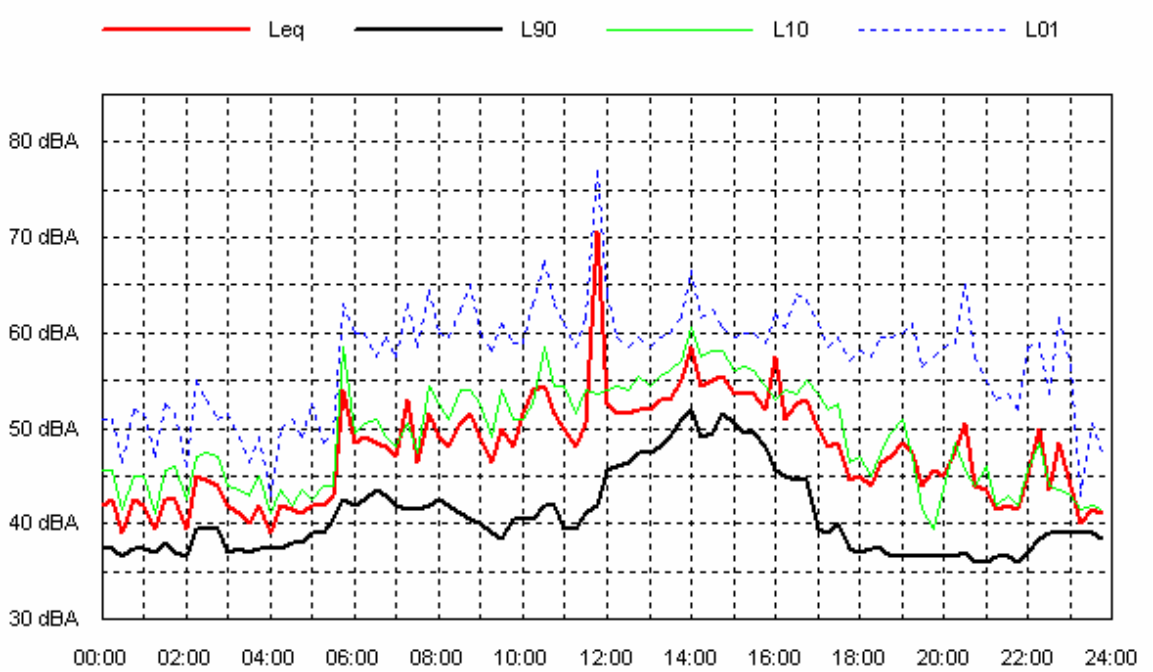


Location: 14 Kamilaroo Avenue

Data shaded: Wind

Tue 23 Aug 05



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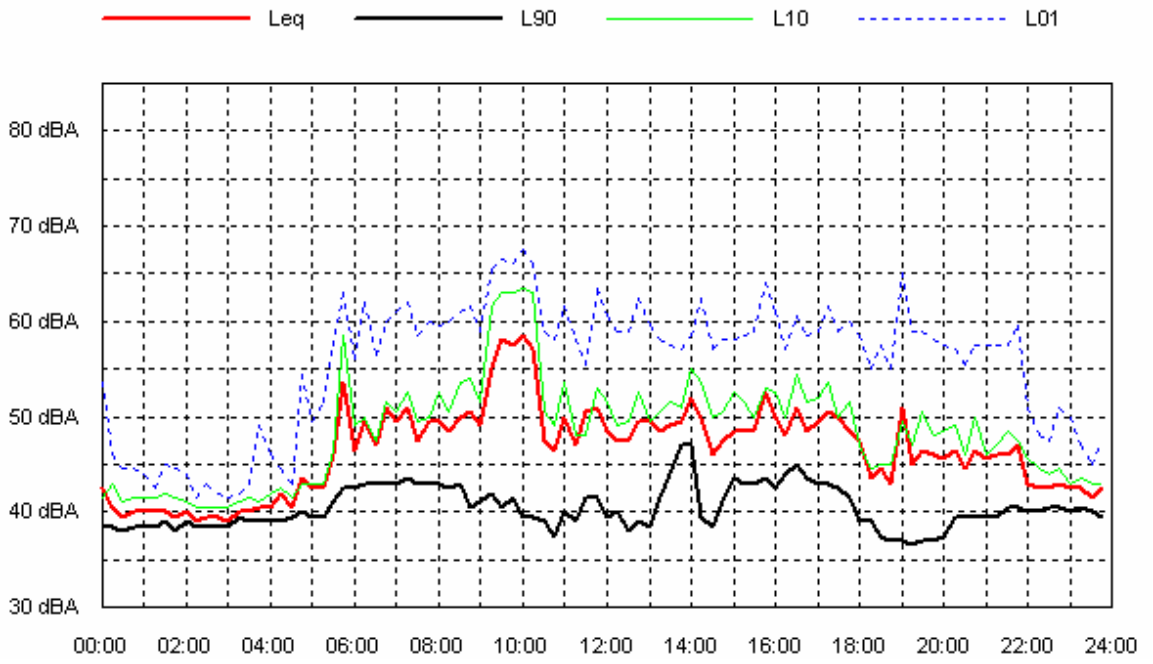
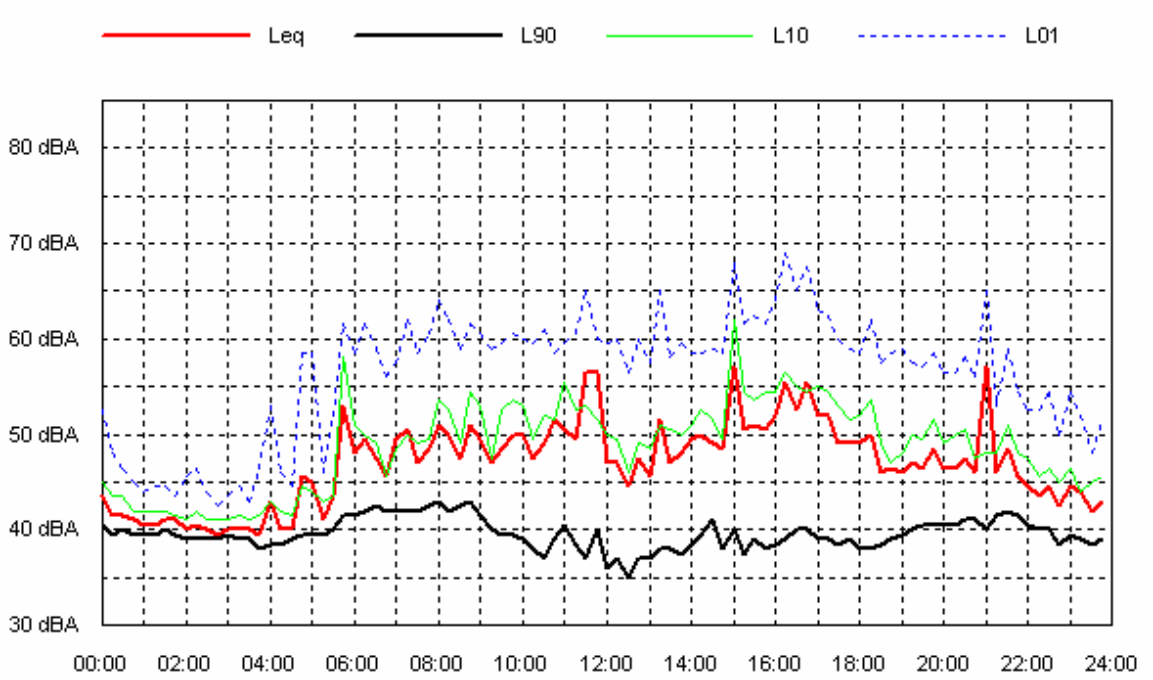


Location: 14 Kamilaroo Avenue

Data shaded: Wind

Thu 25 Aug 05



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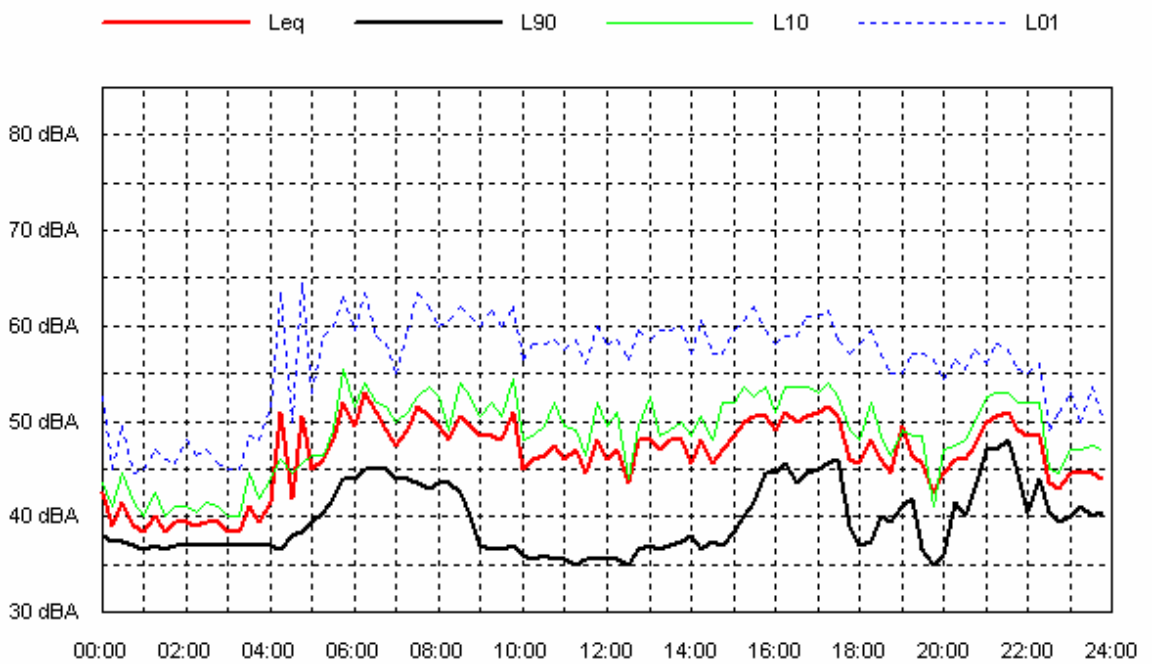

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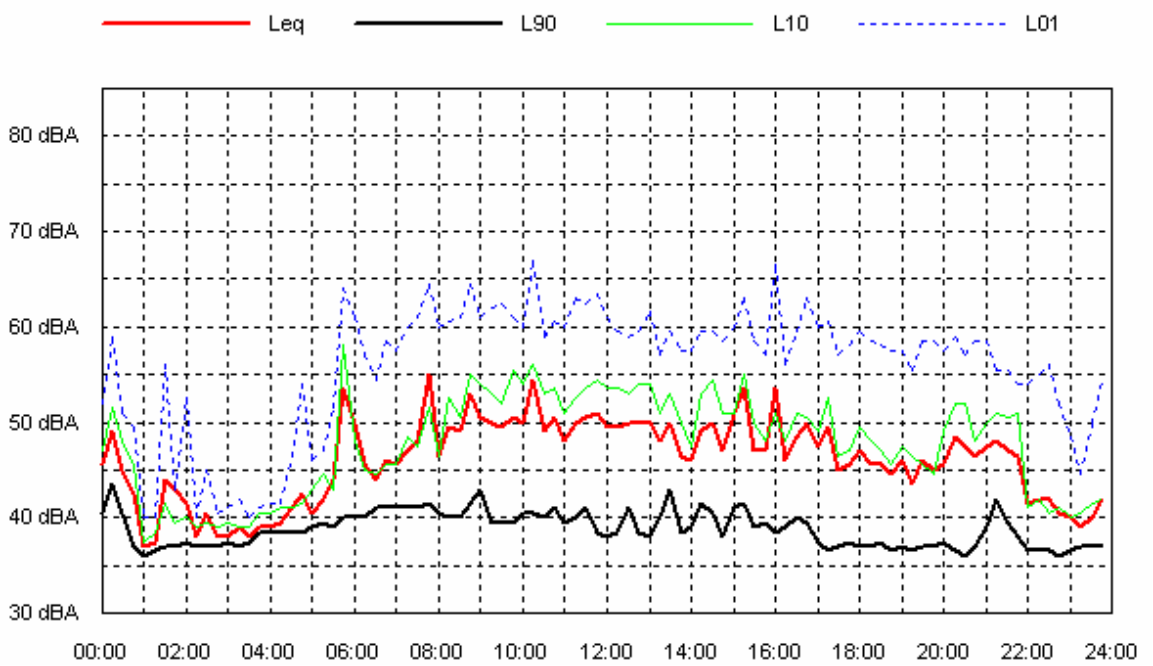

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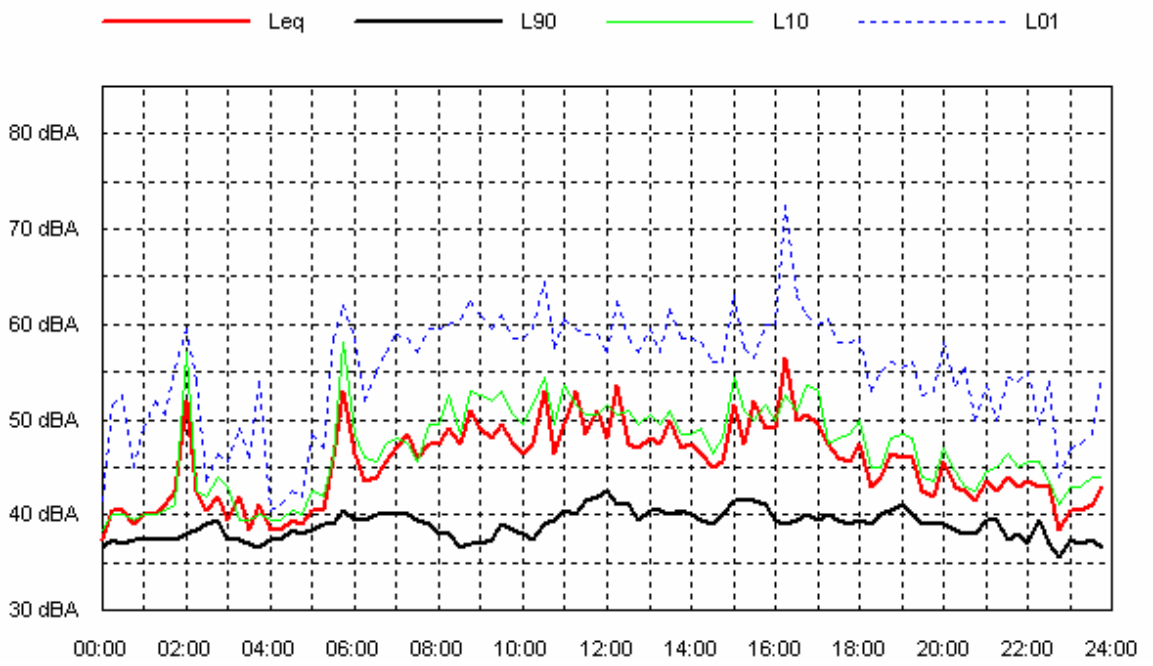

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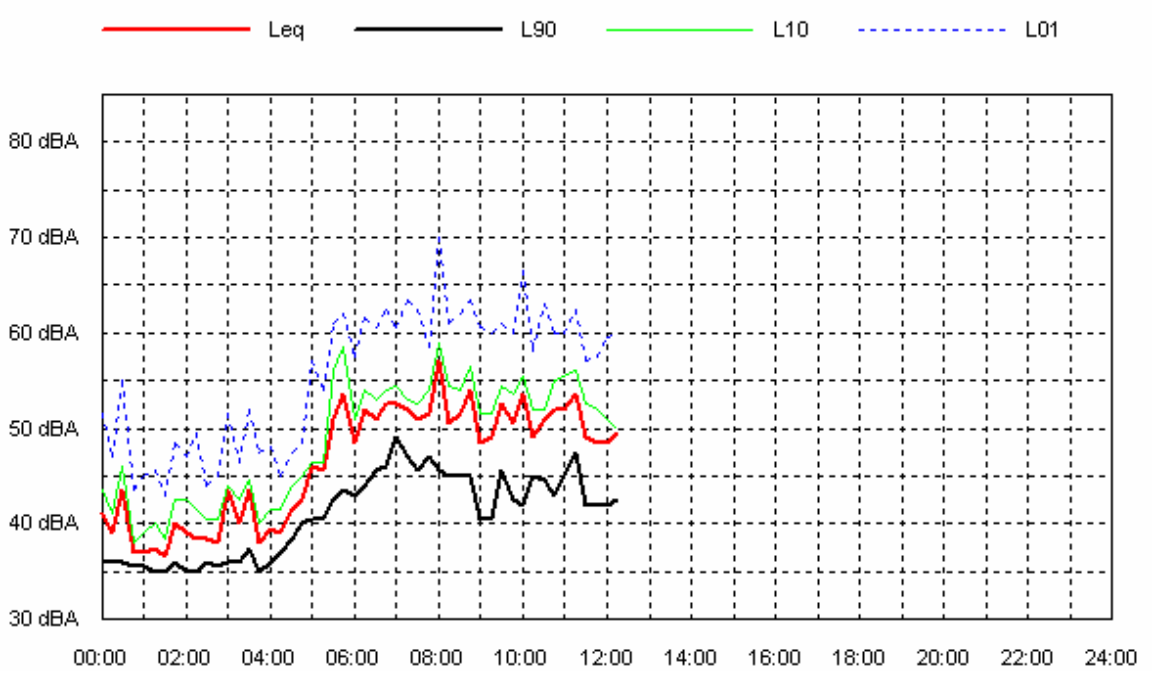

Location: 127 Woolana Road

Data shaded: Wind

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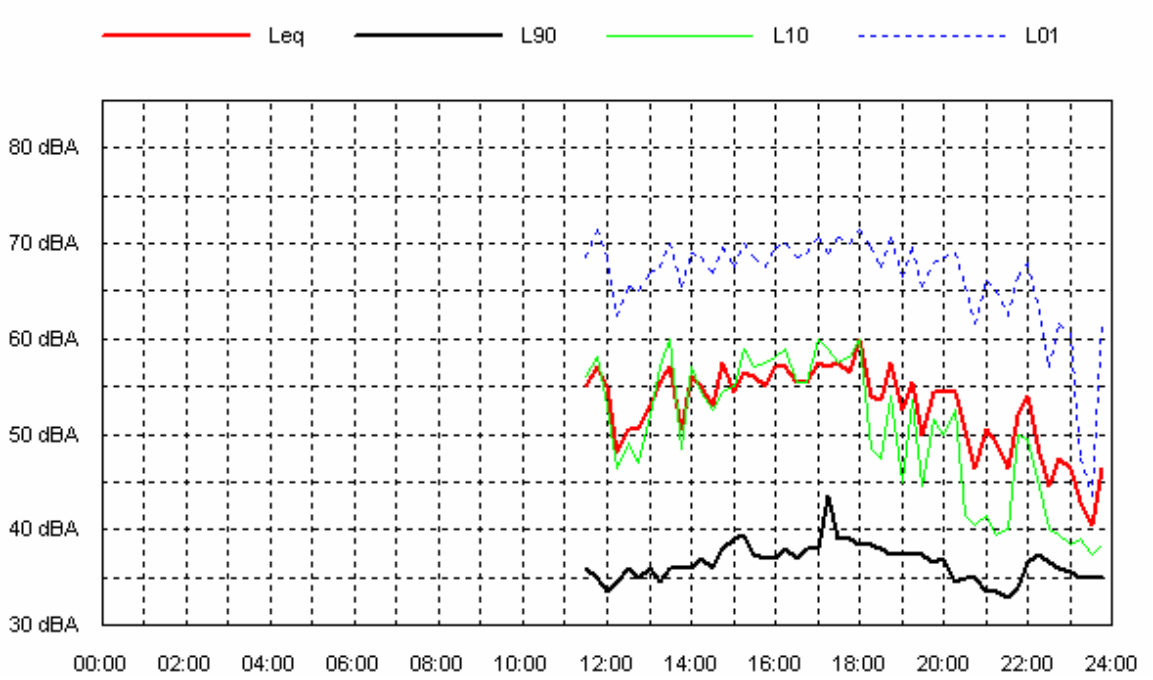

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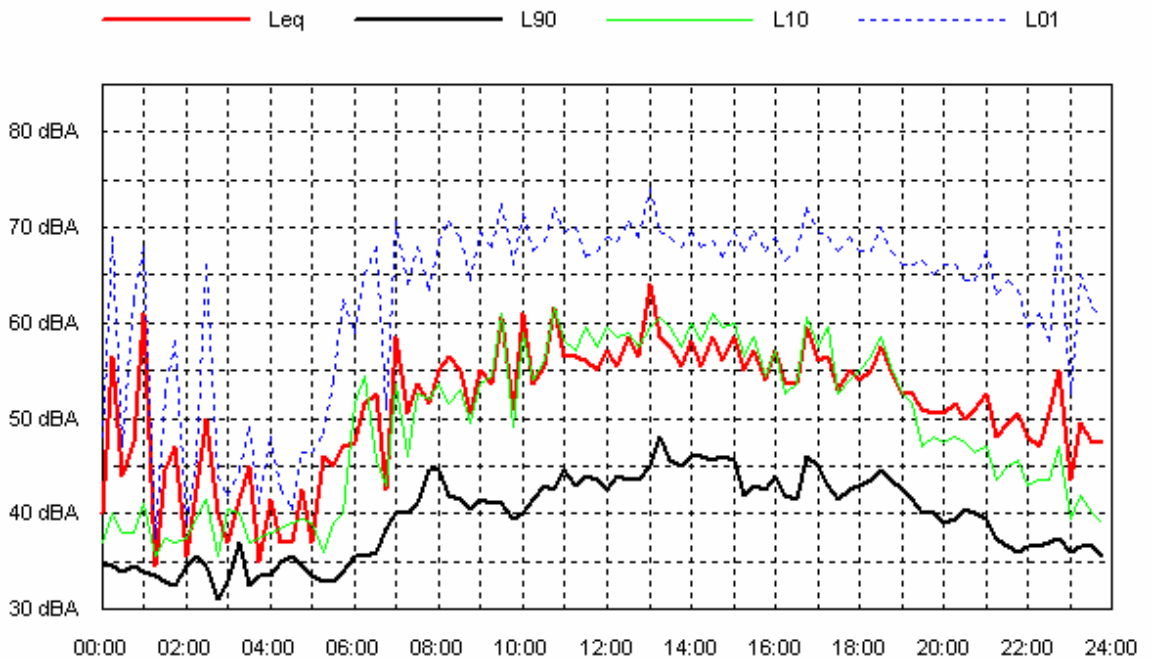

Location: 127 Woolana Road

Data shaded: Wind

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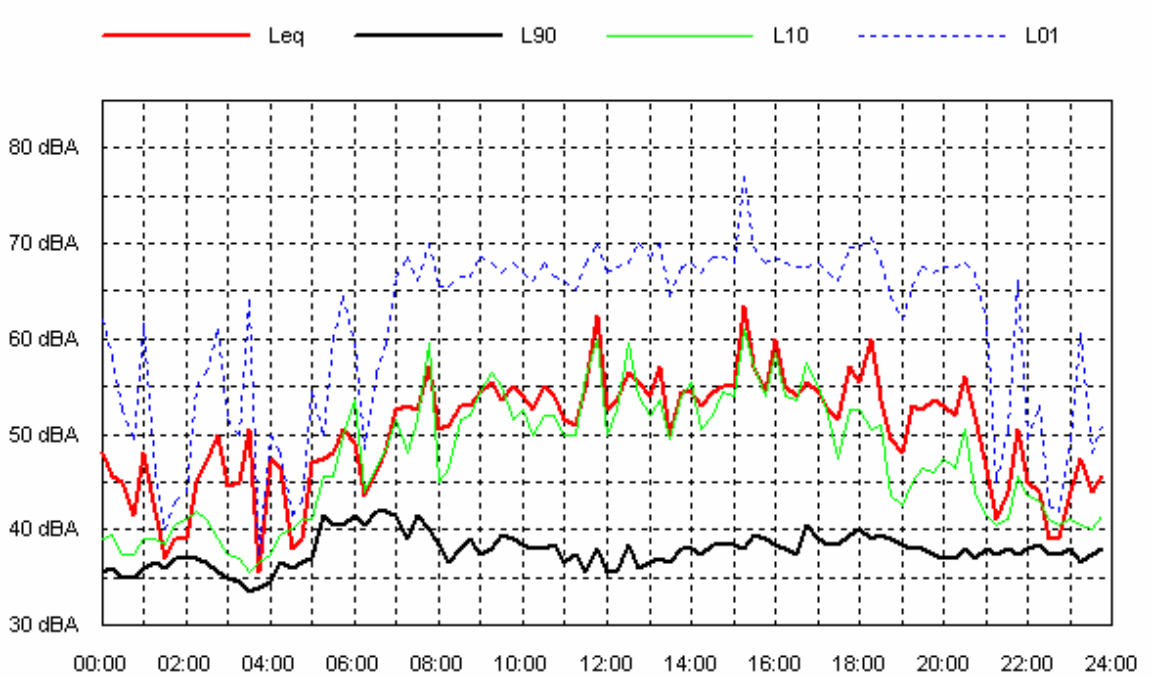

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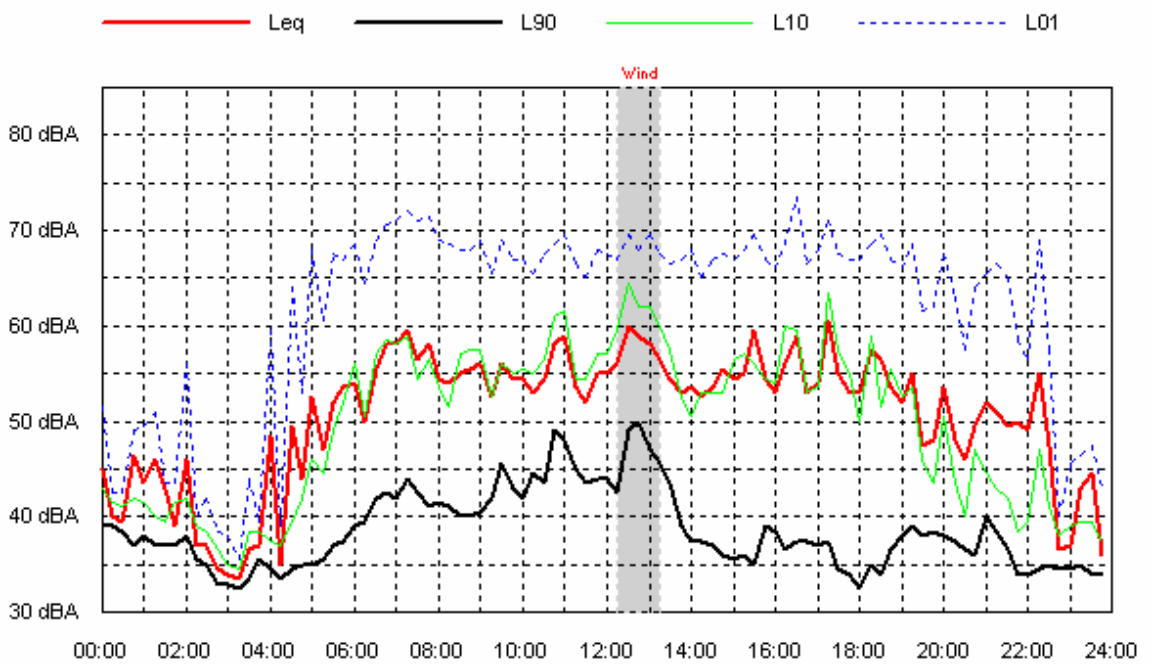

Location: 127 Woolana Road

Data shaded: Wind

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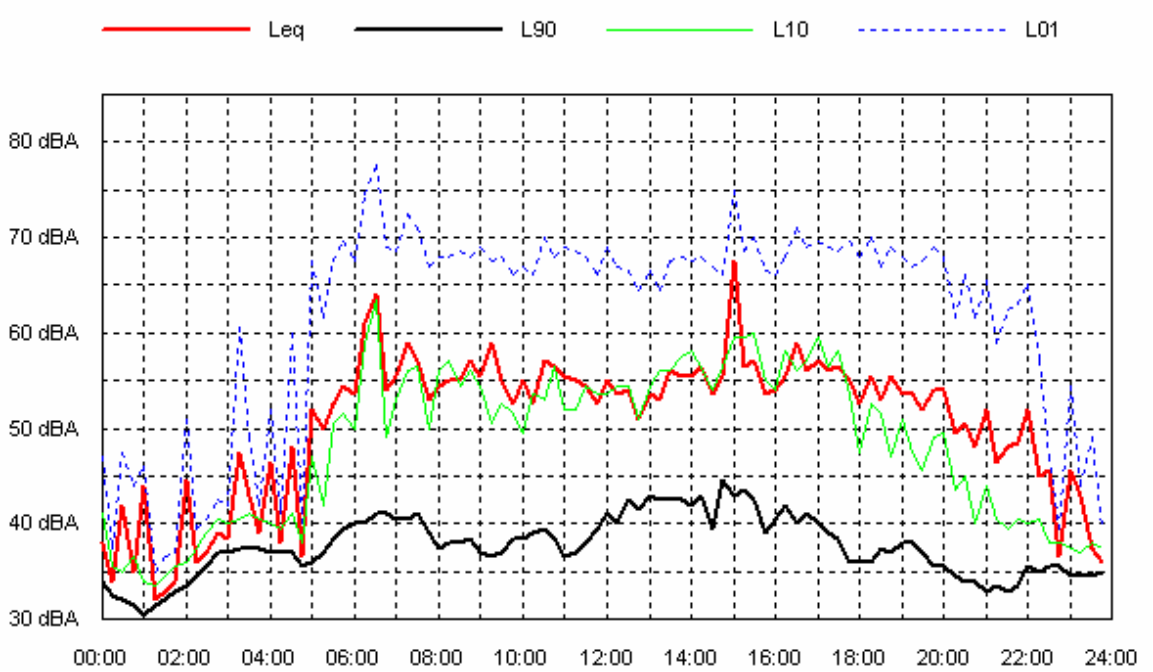

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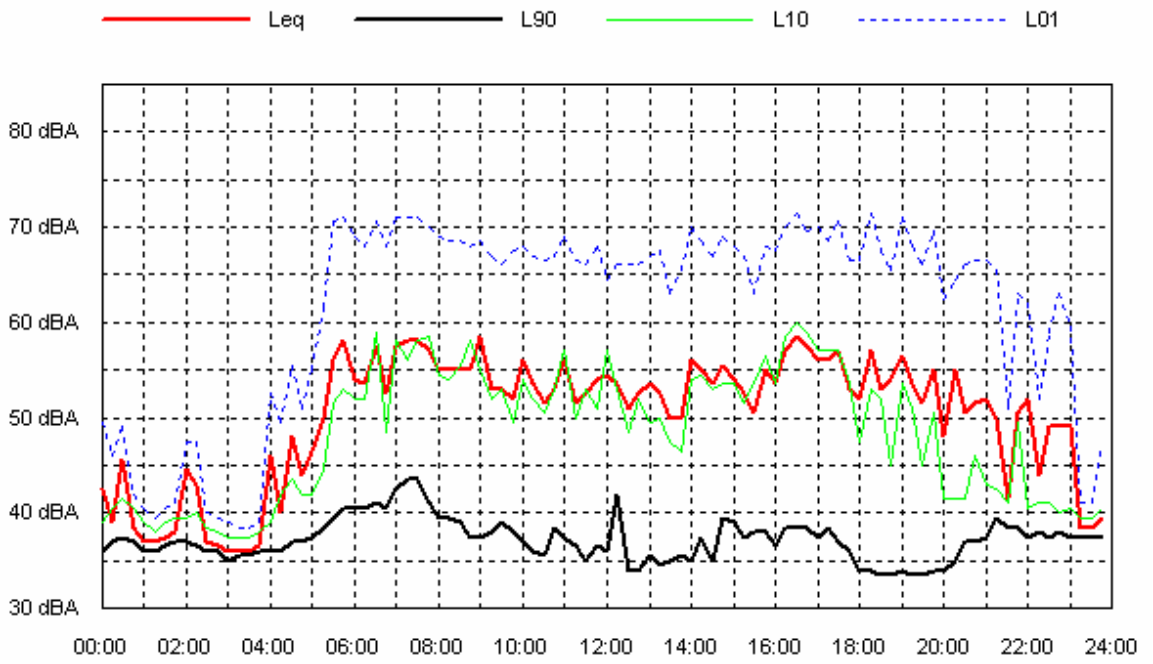

Location: 127 Woolana Road

Data shaded: Wind

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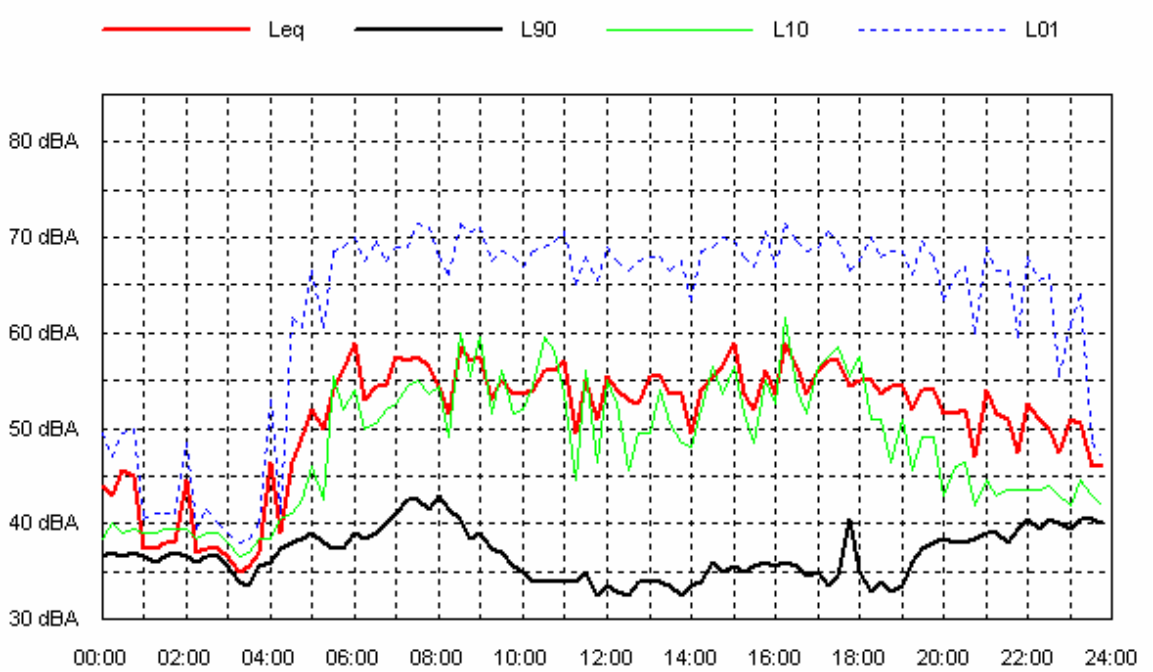

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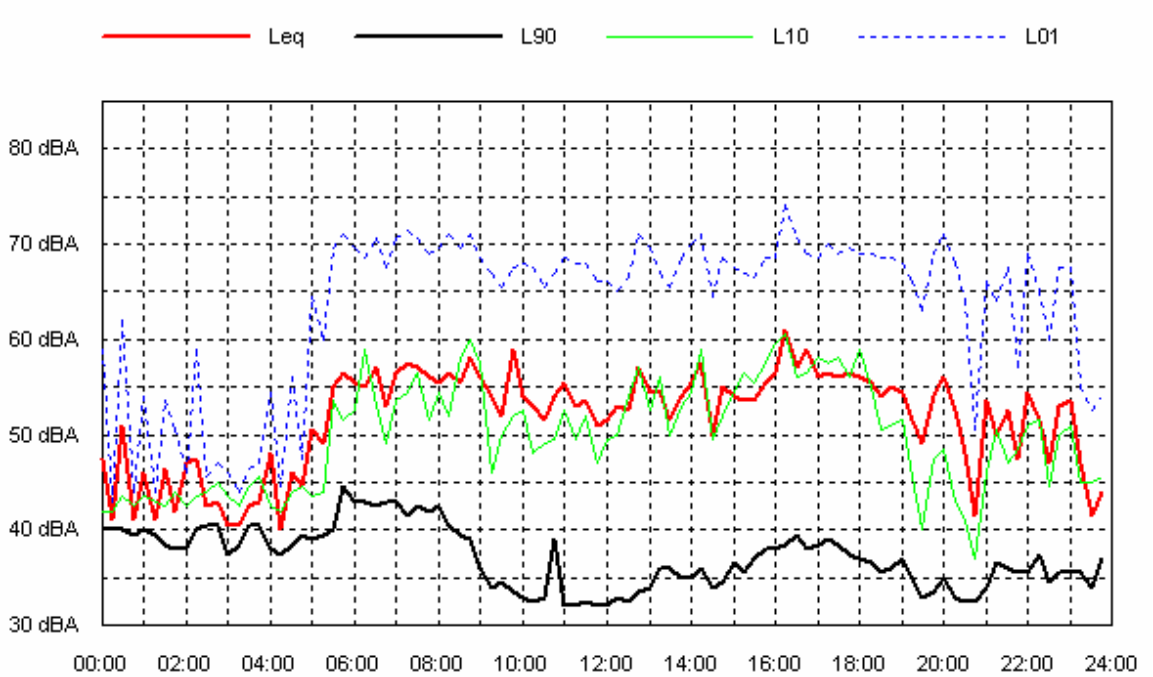

Location: 127 Woolana Road

Data shaded: Wind

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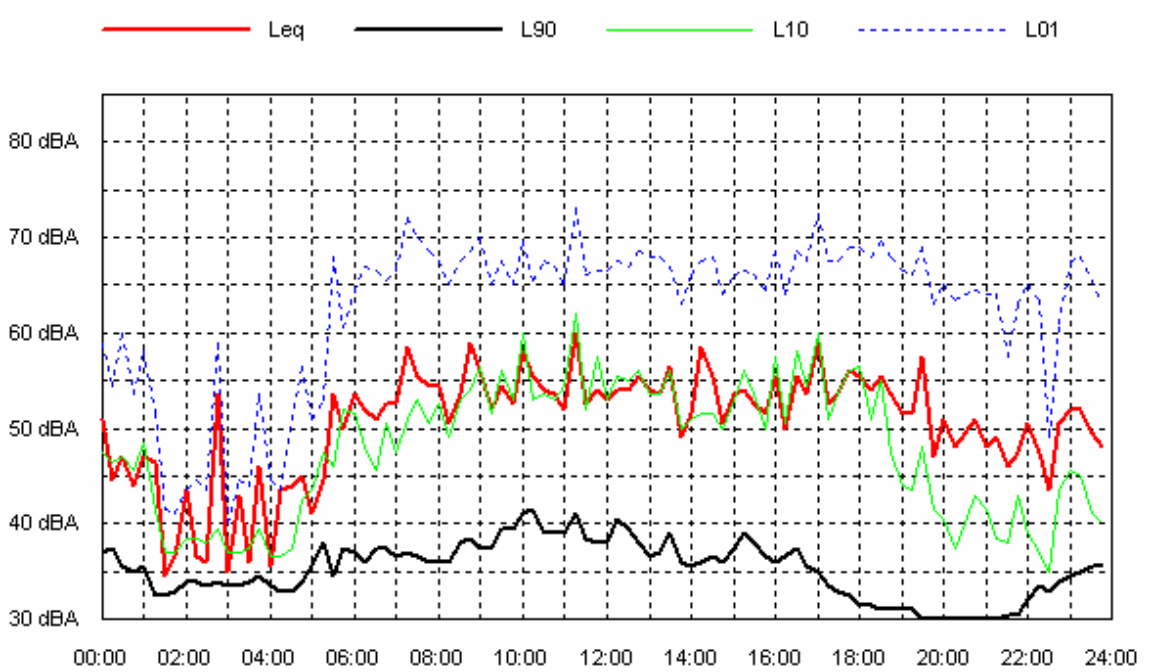

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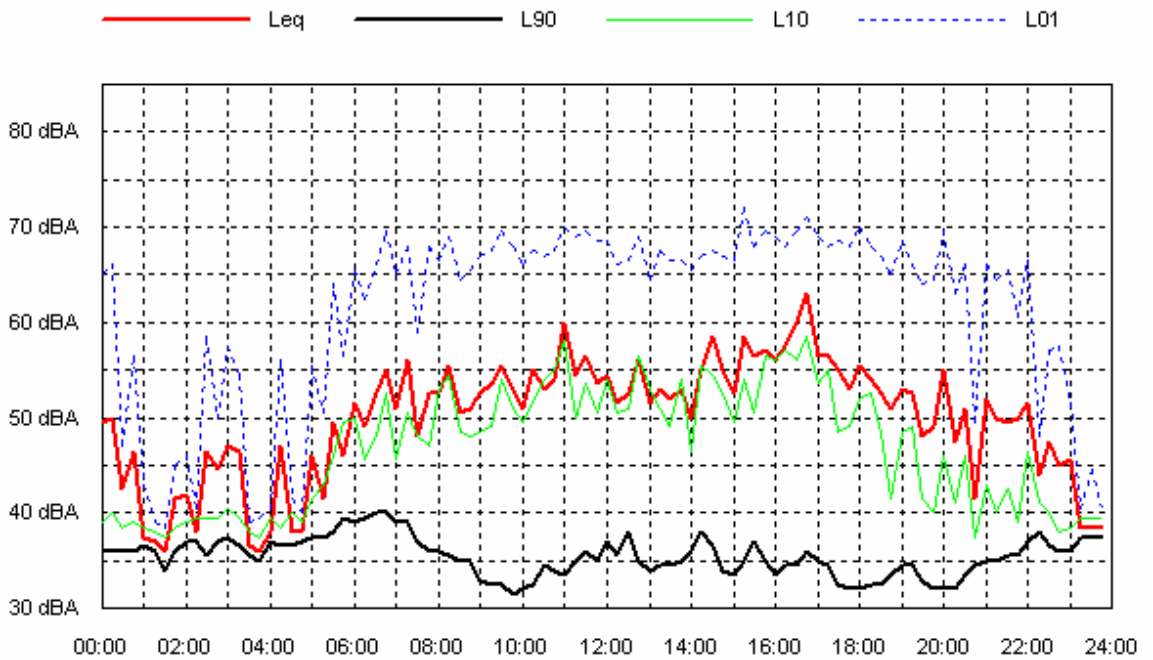

Location: 127 Woolana Road

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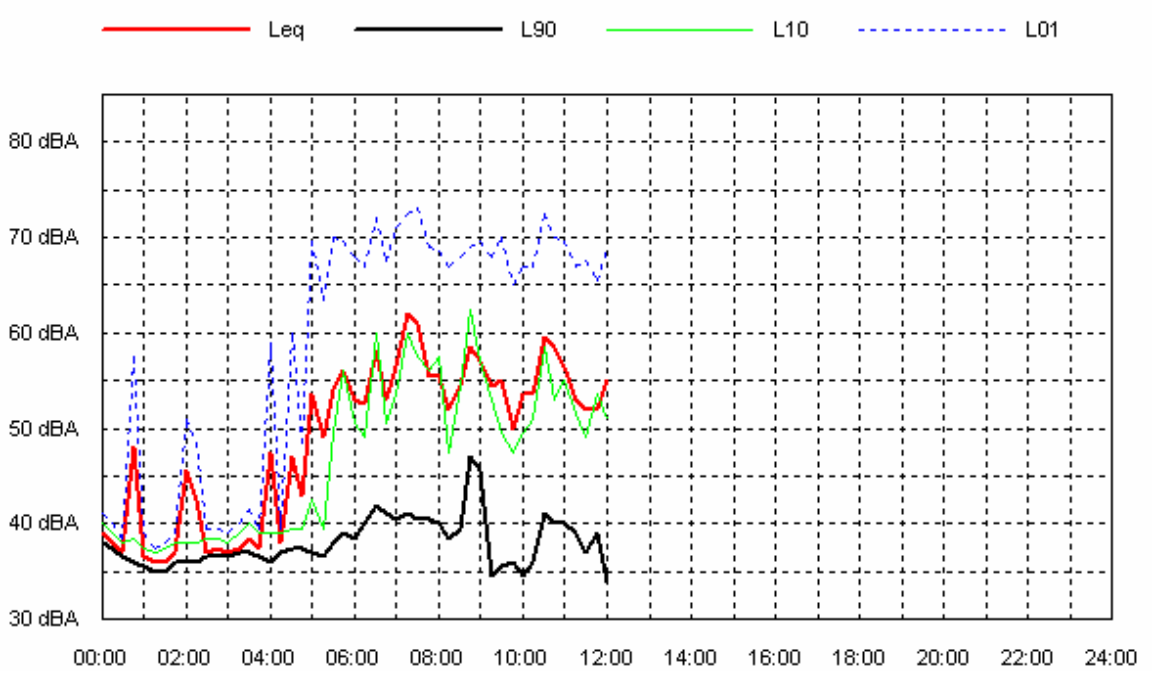
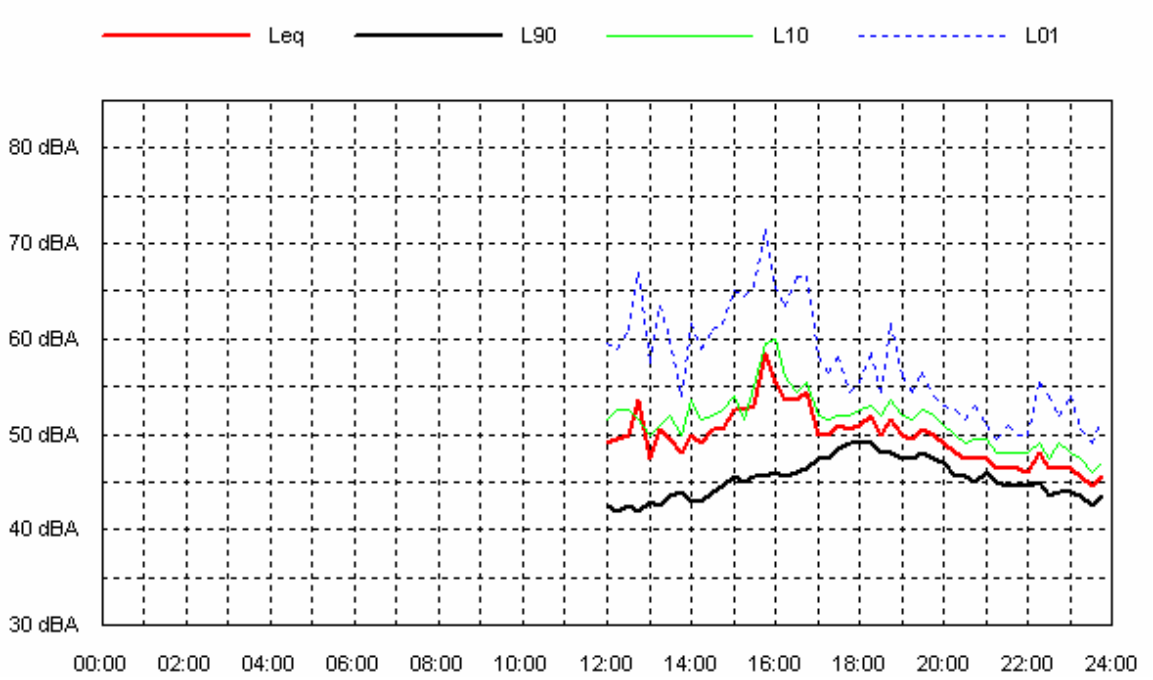


Location: 32 Barega Close

Data shaded: Wind

Fri 19 Aug 05



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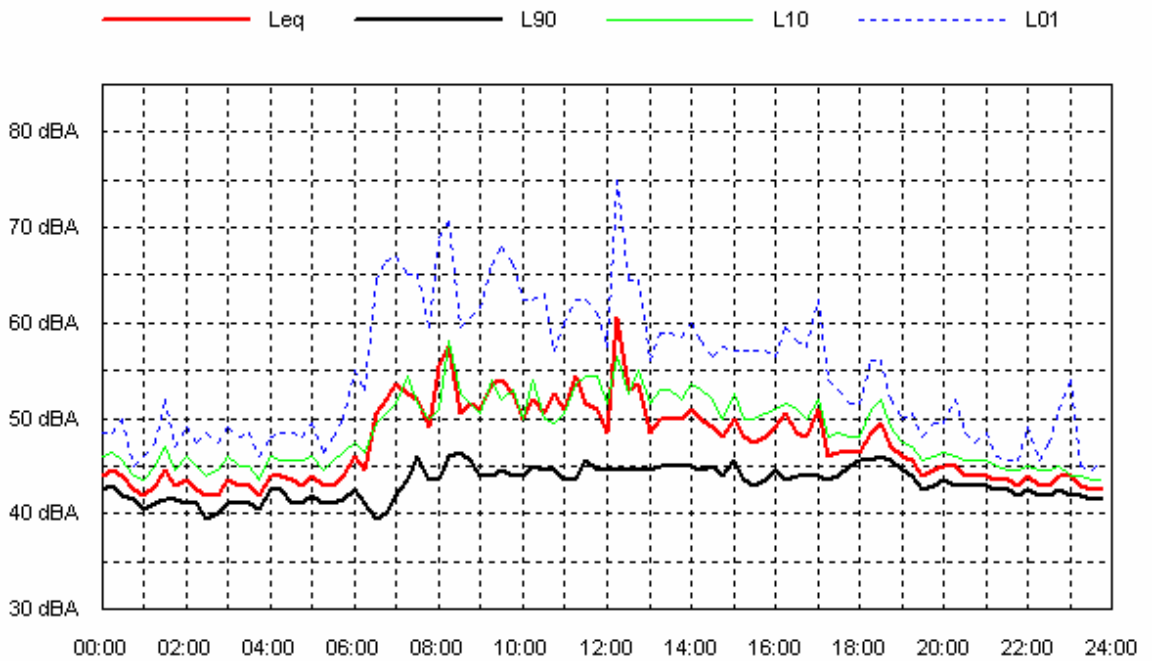

Location: 32 Barega Close

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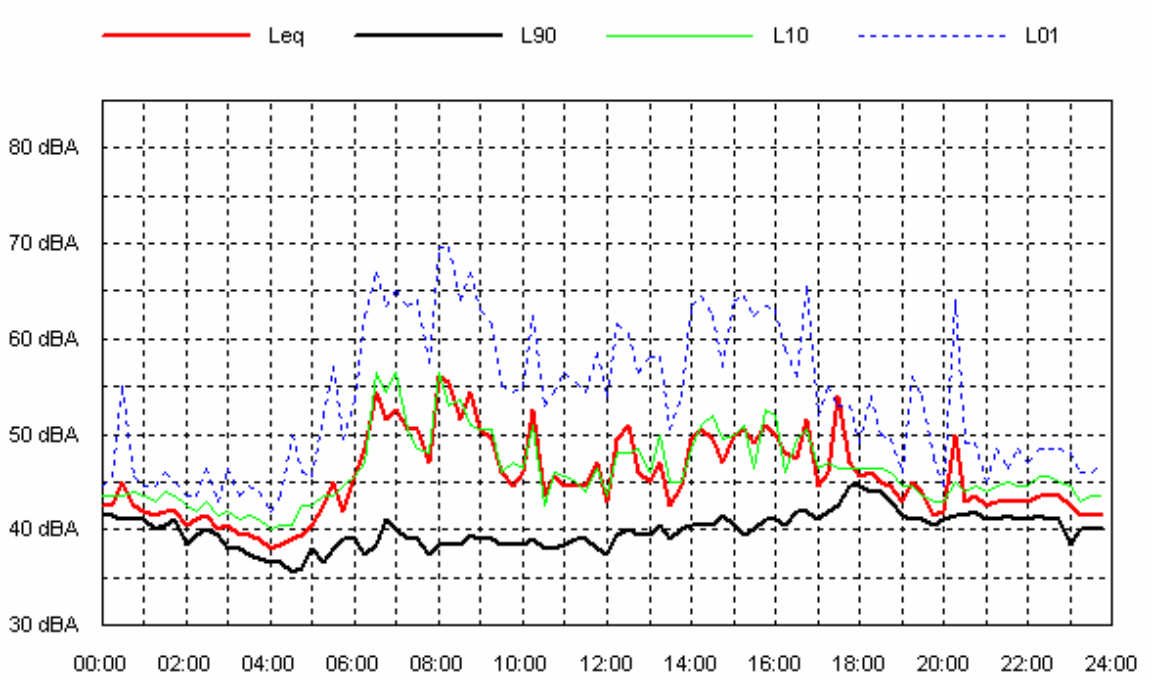

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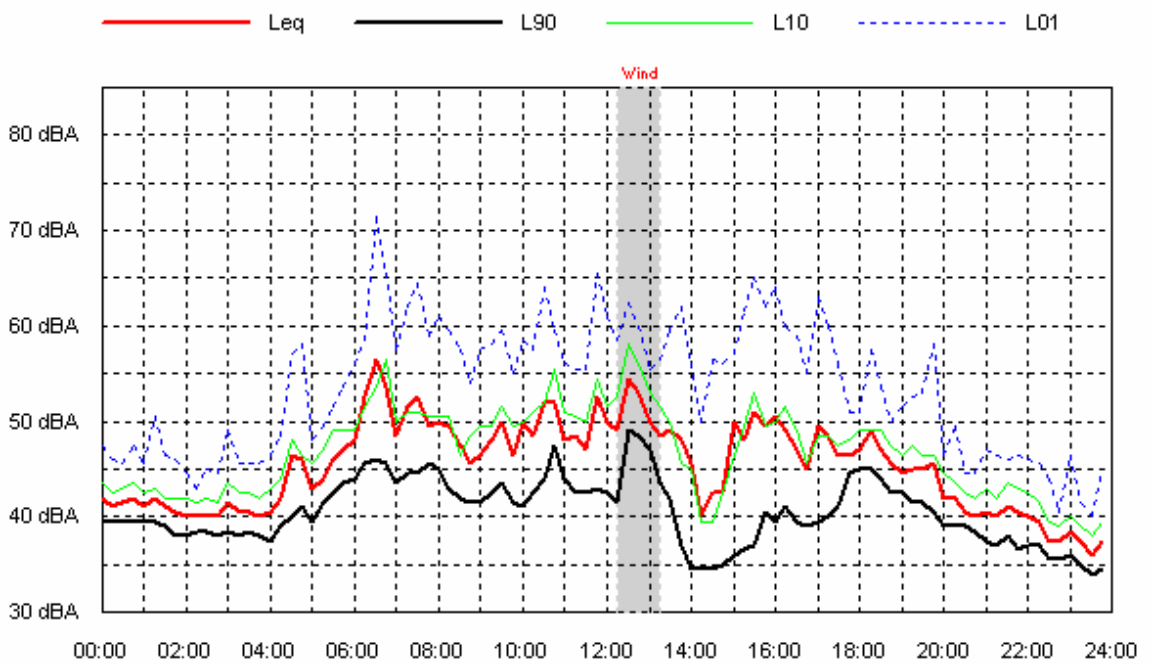

Location: 32 Barega Close

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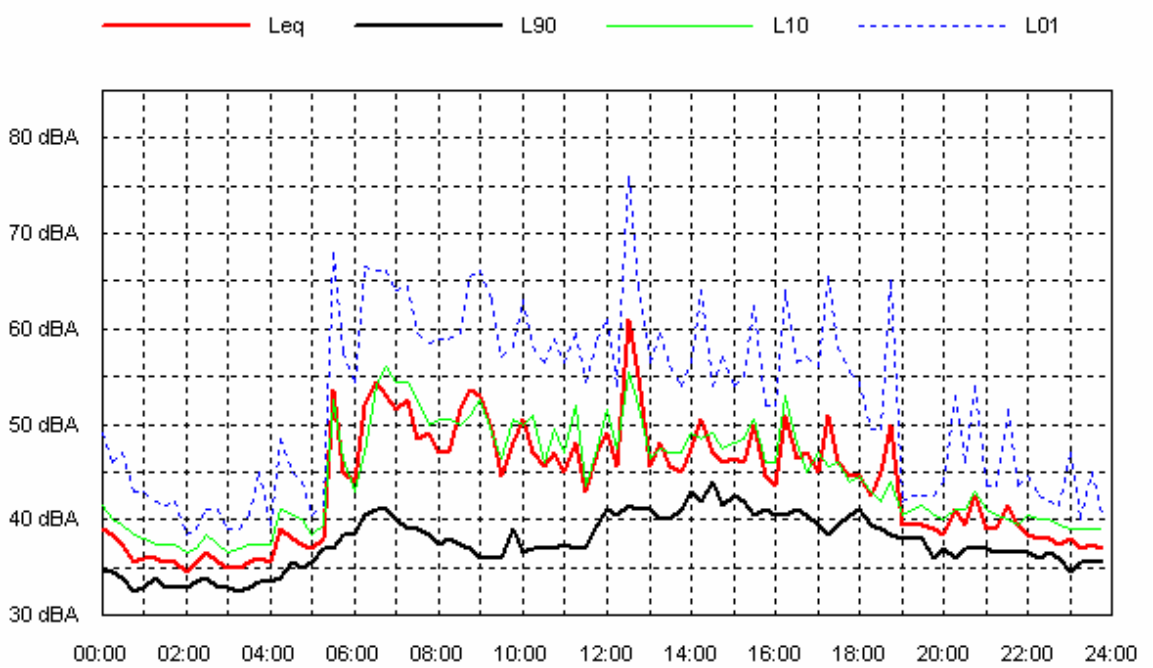

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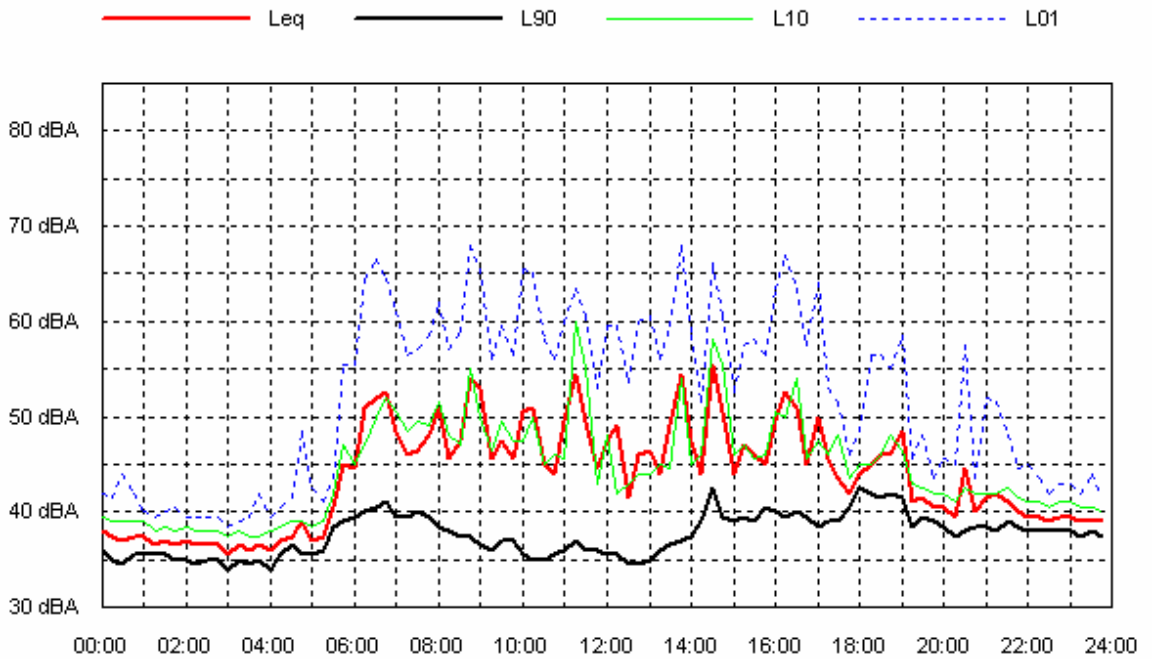

Location: 32 Barega Close

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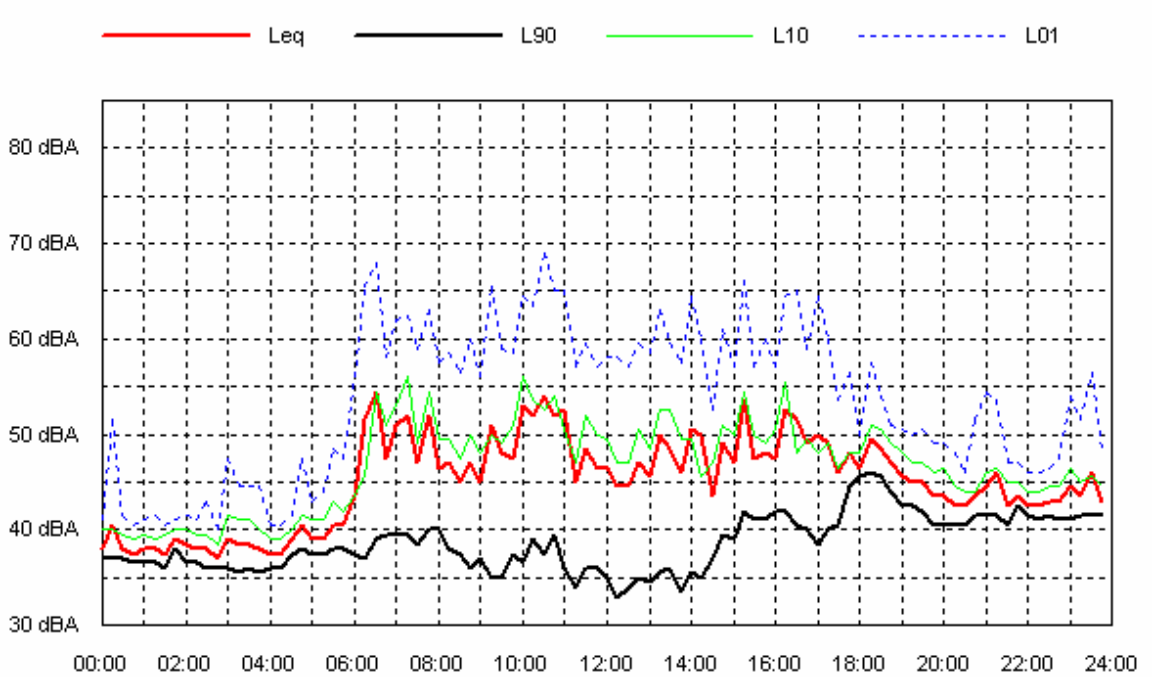

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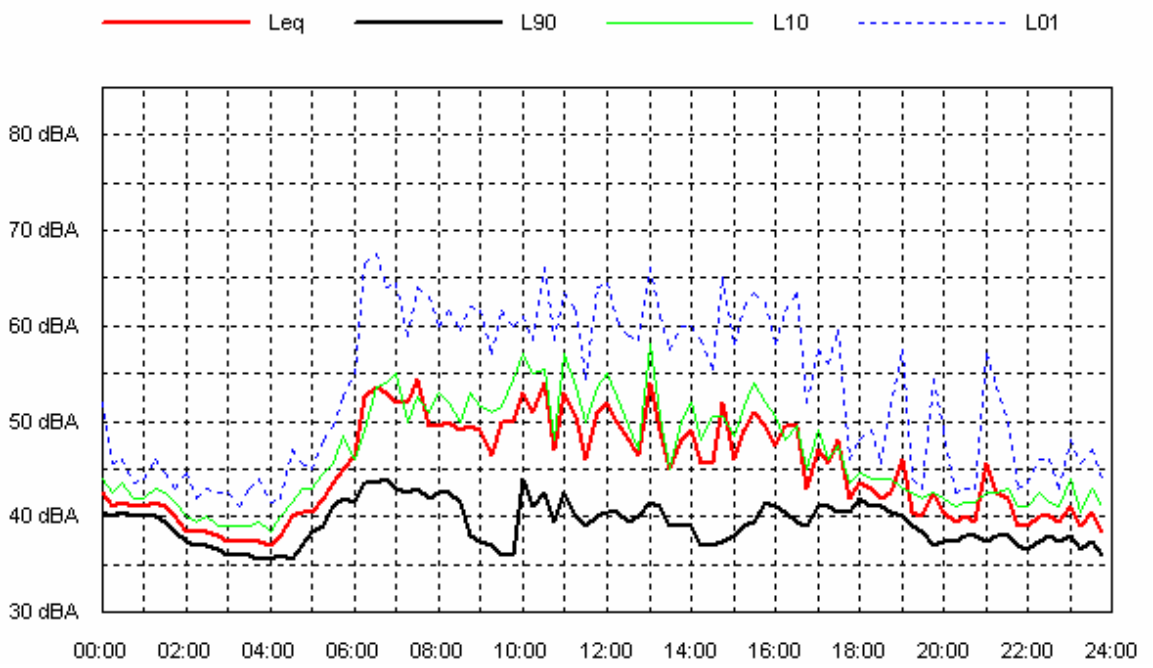
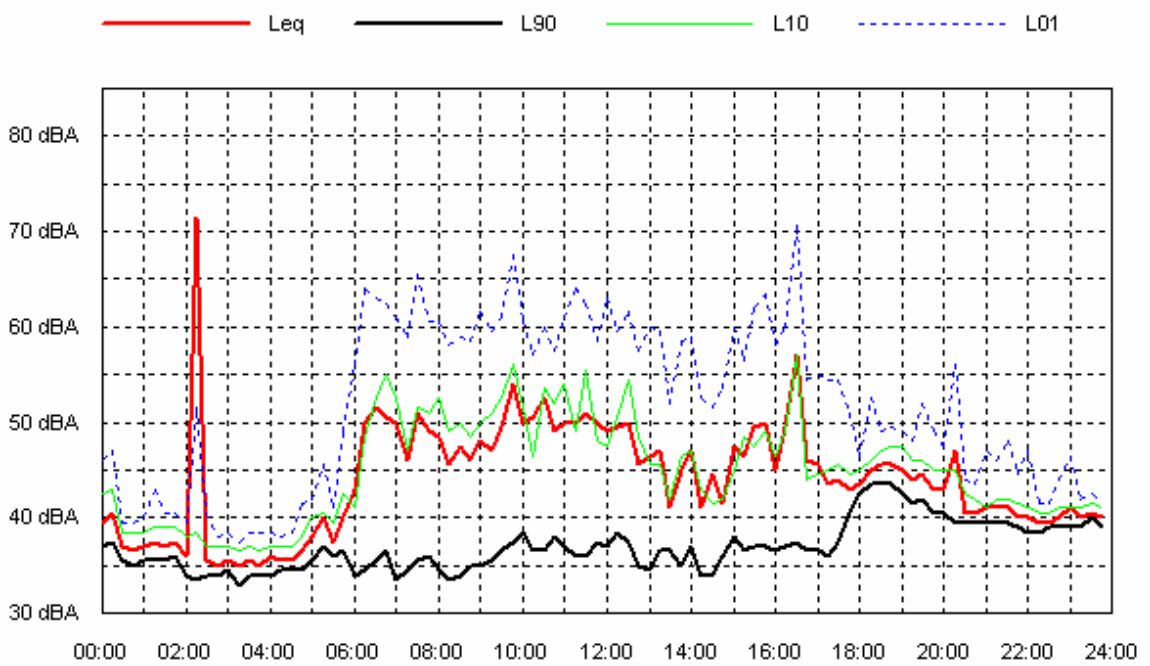


Location: 32 Barega Close

Data shaded: Wind

Sat 27 Aug 05



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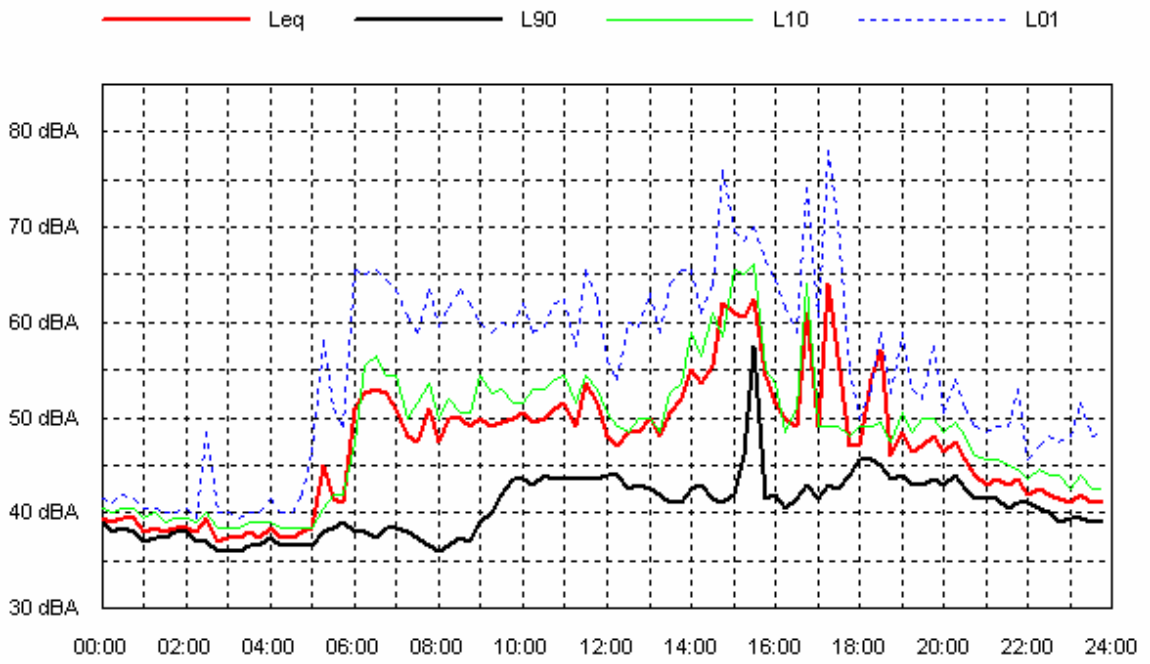

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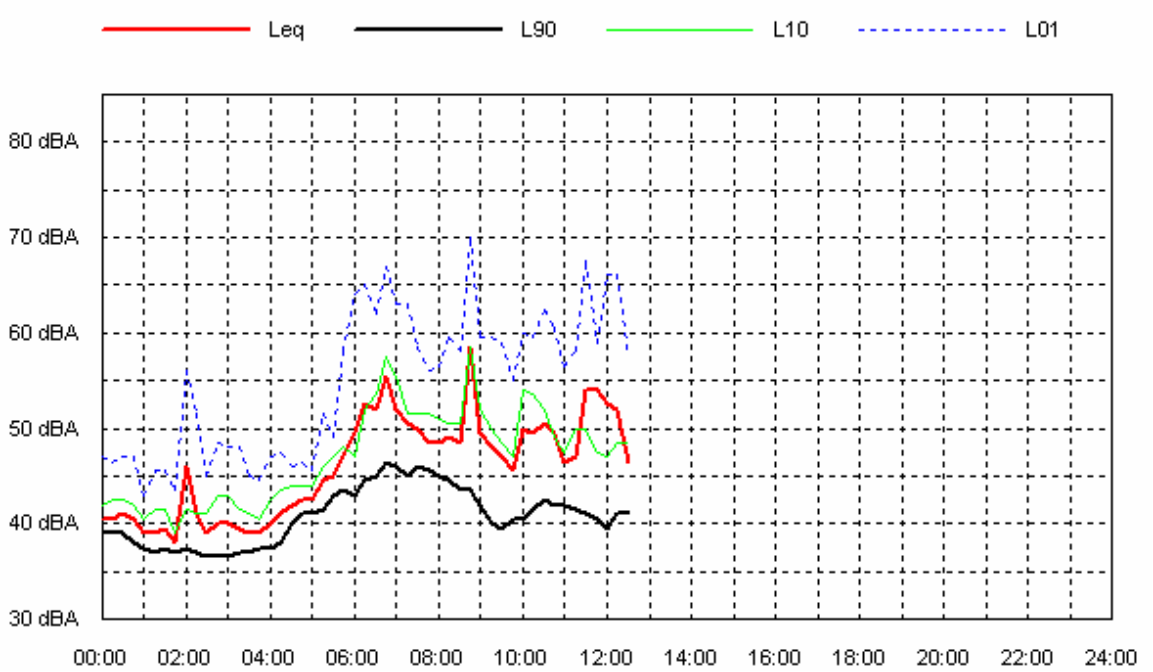
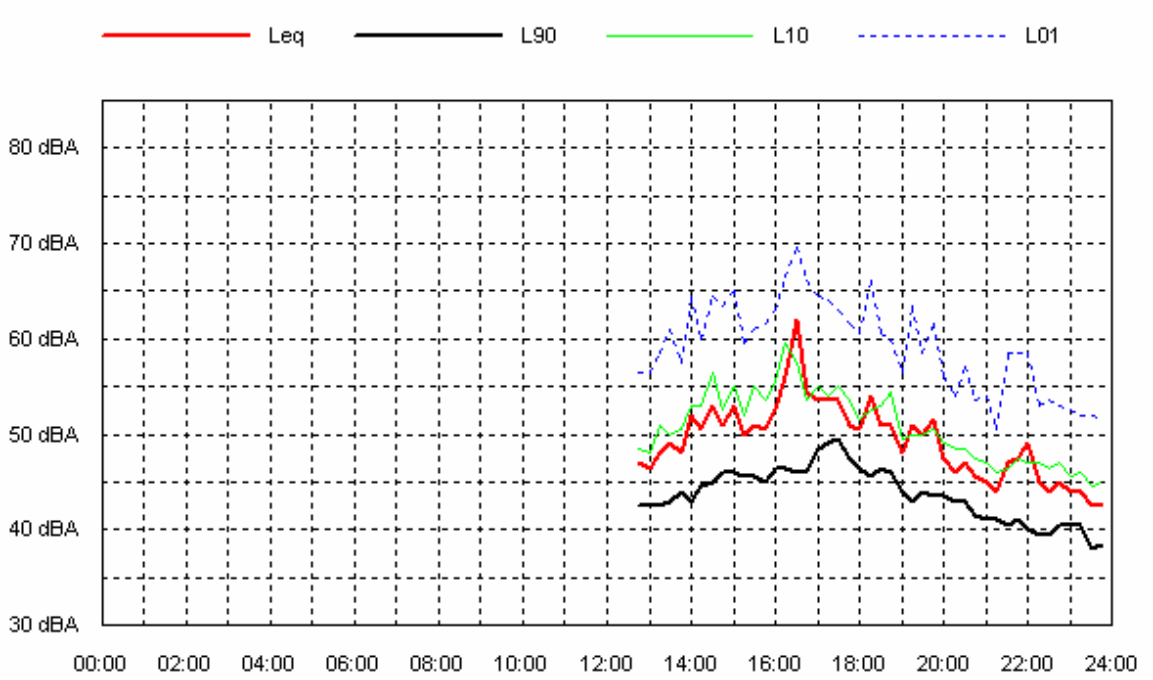


Location: 83 Perouse Avenue

Data shaded: Wind

Fri 19 Aug 05



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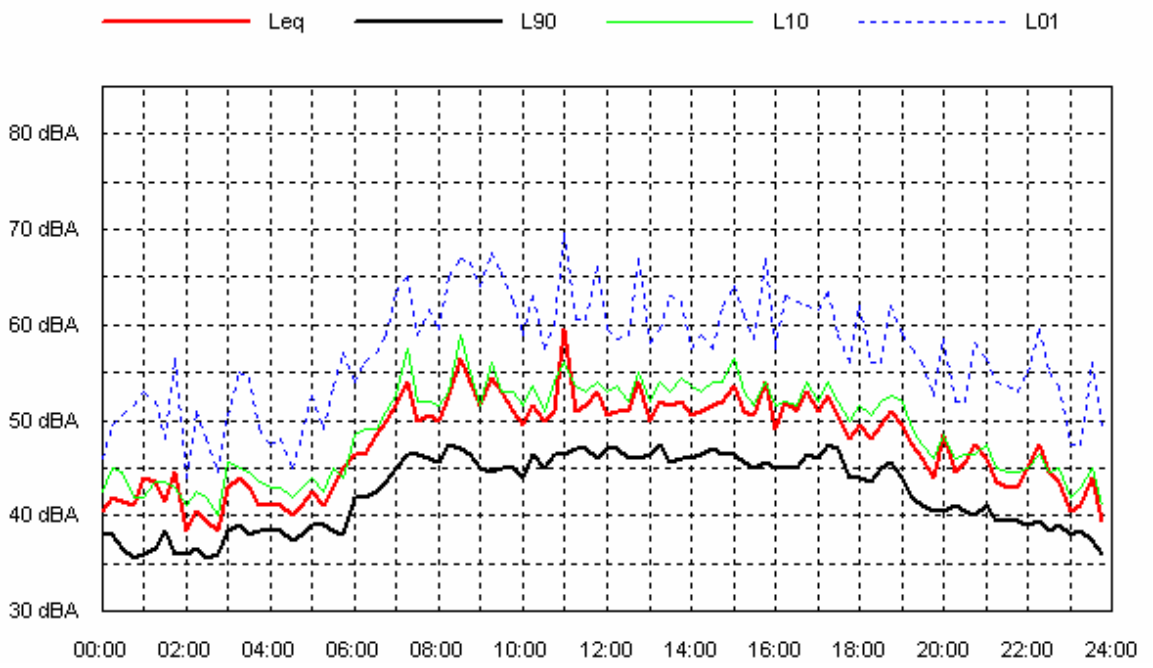

Location: 83 Perouse Avenue

Data shaded: Wind

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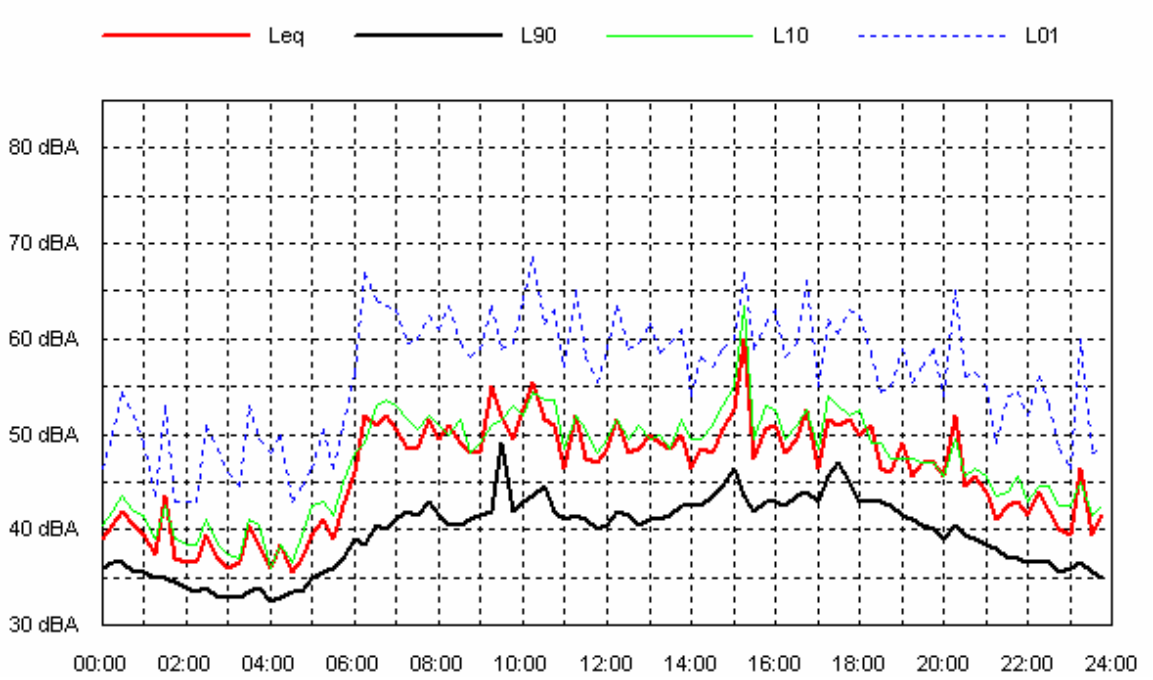

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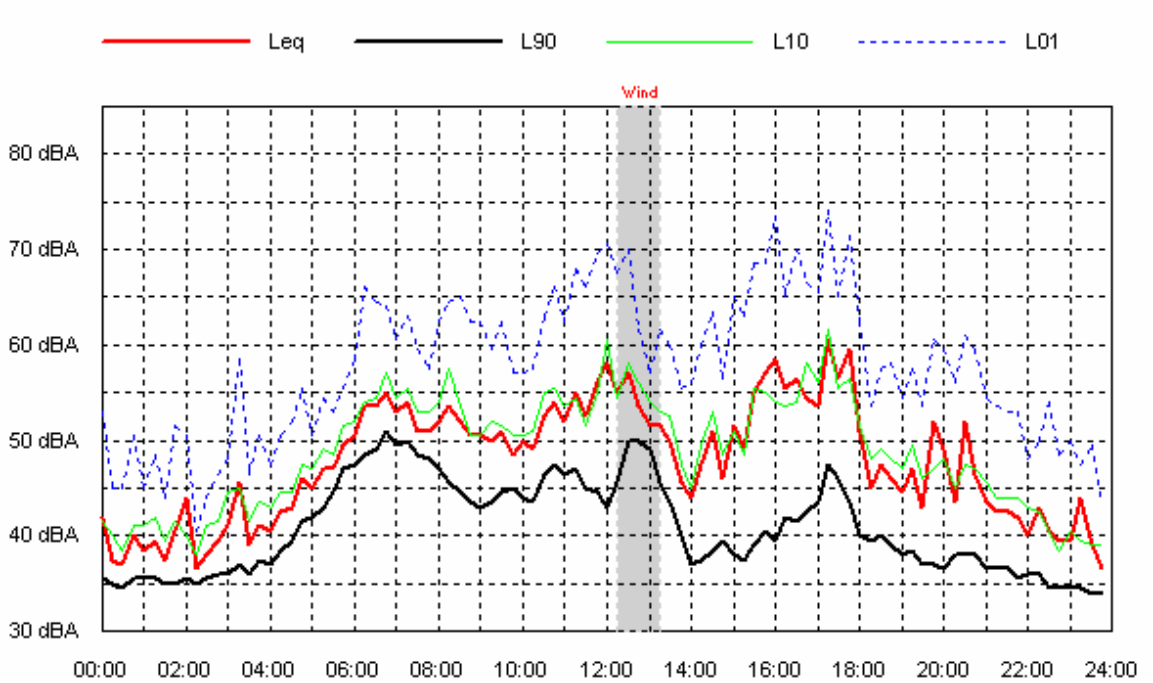
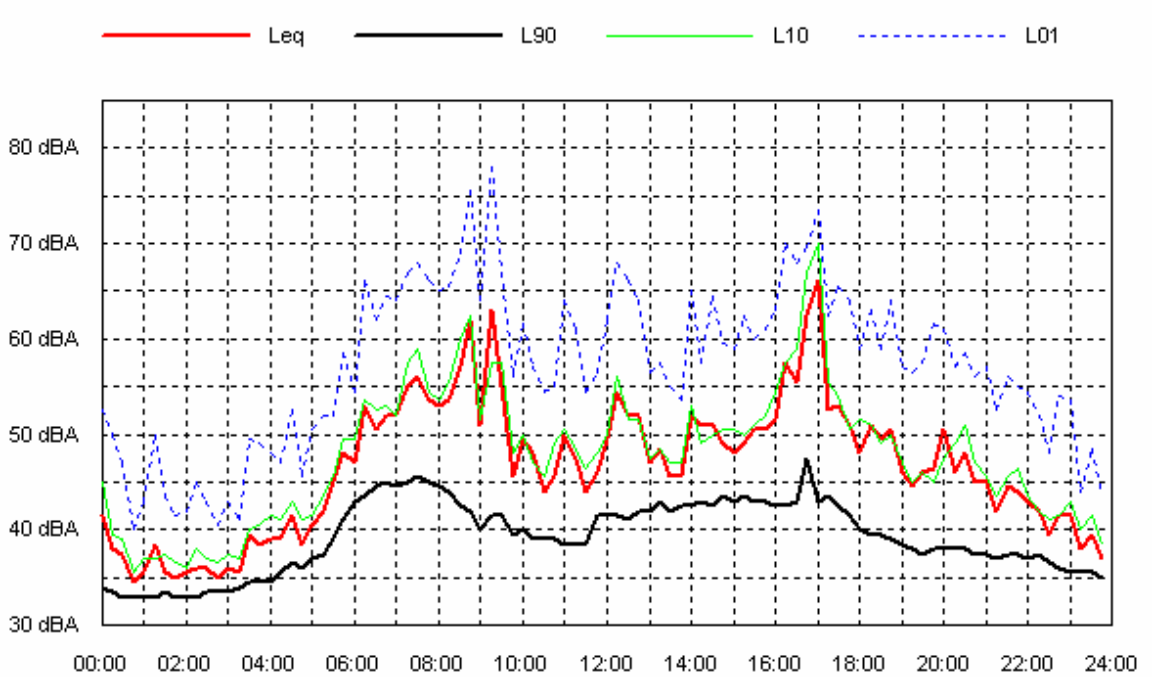


Location: 83 Perouse Avenue

Data shaded: Wind

Tue 23 Aug 05



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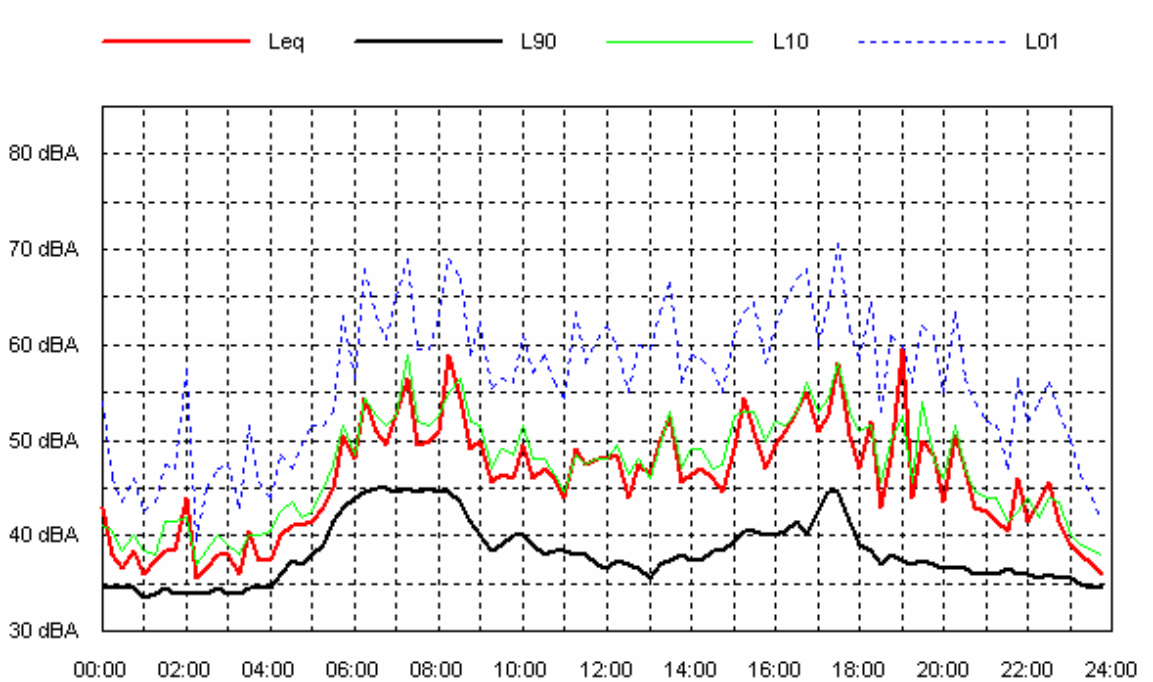
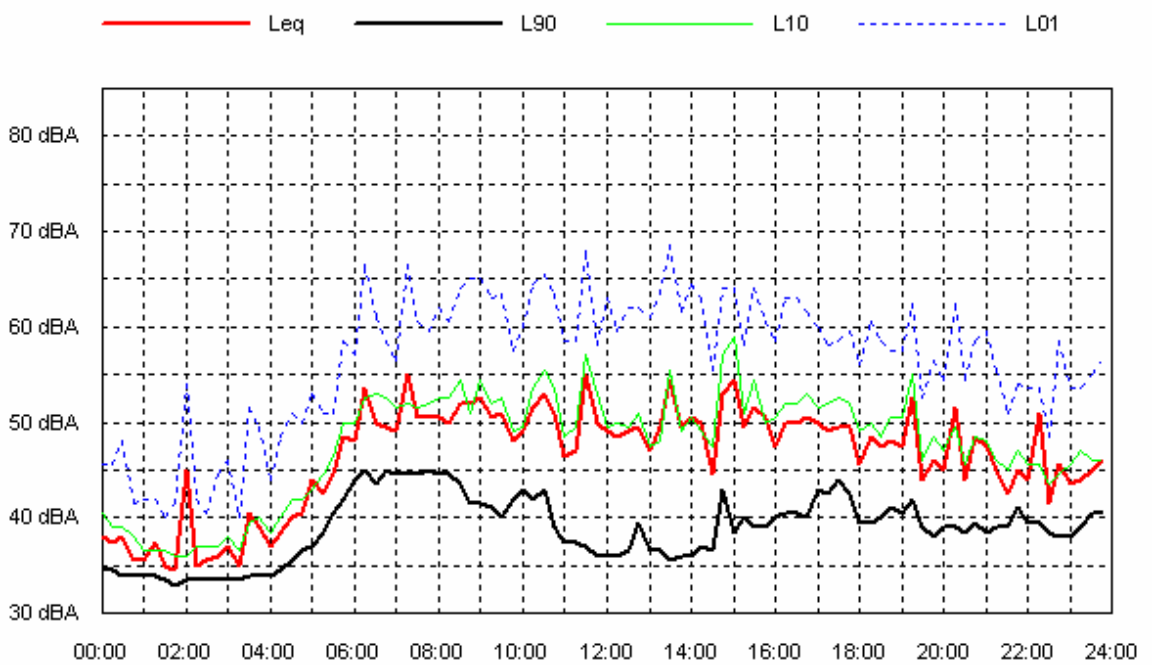


Location: 83 Perouse Avenue

Data shaded: Wind

Thu 25 Aug 05



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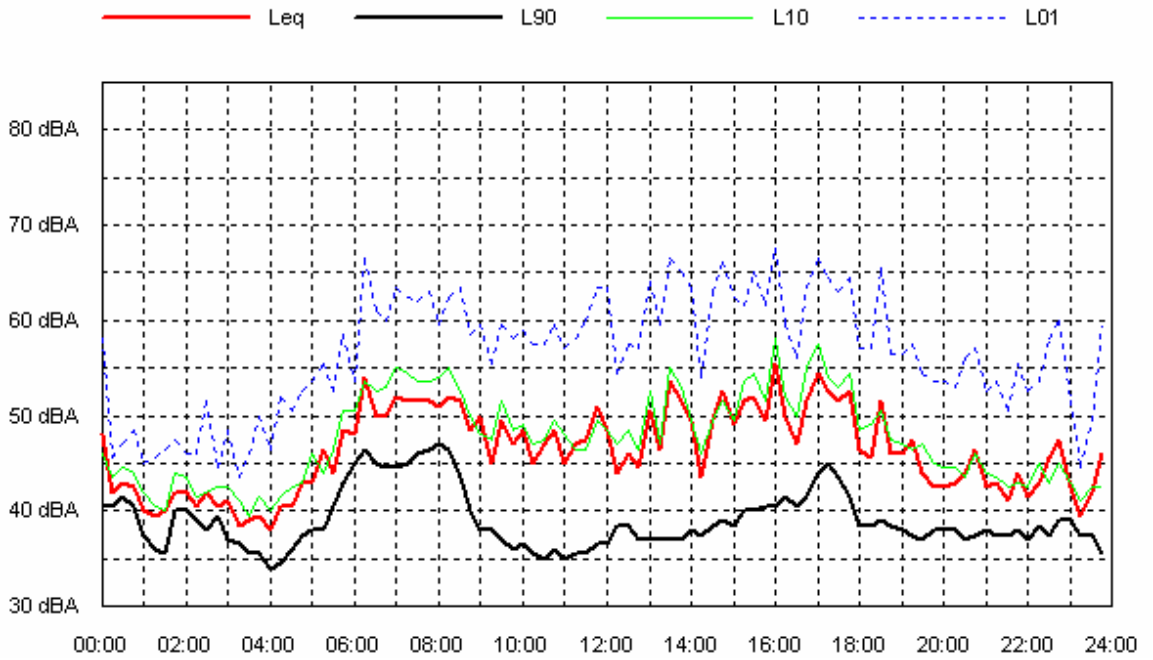
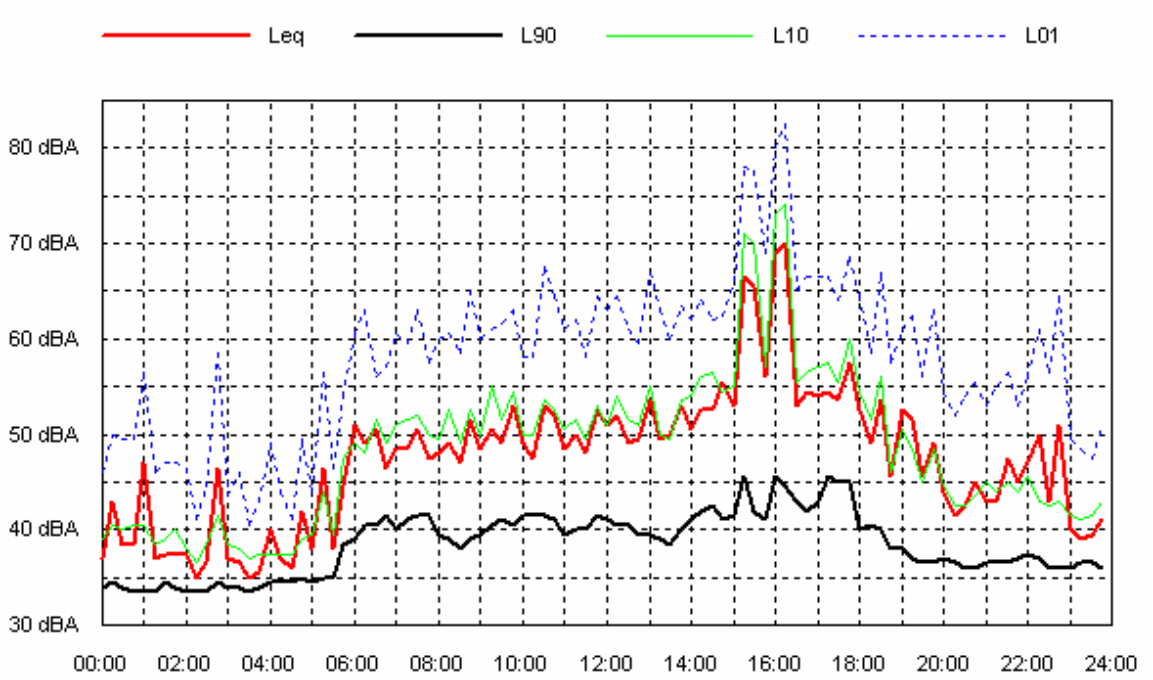


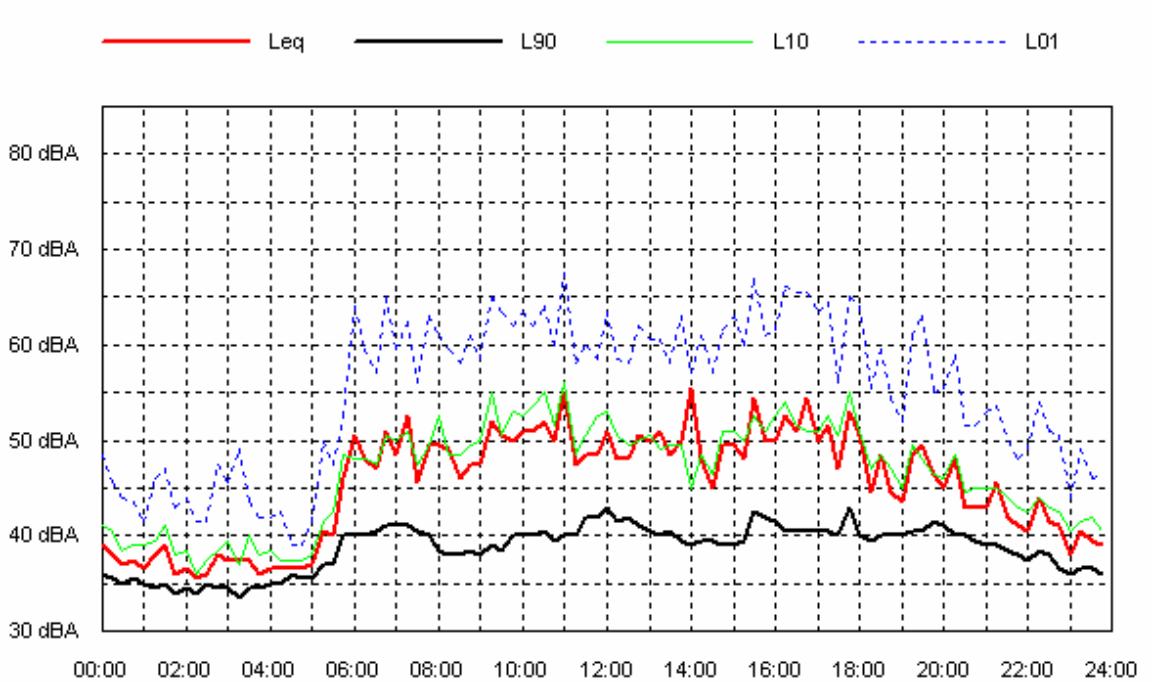
Location: 83 Perouse Avenue

Data shaded: Wind

Sat 27 Aug 05



Sun 28 Aug 05



Location: 83 Perouse Avenue

Data shaded: Wind

Mon 29 Aug 05